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Chicago, December 27, 1924 (*Issued Every Other Week*) Volume XXVII, No. 26

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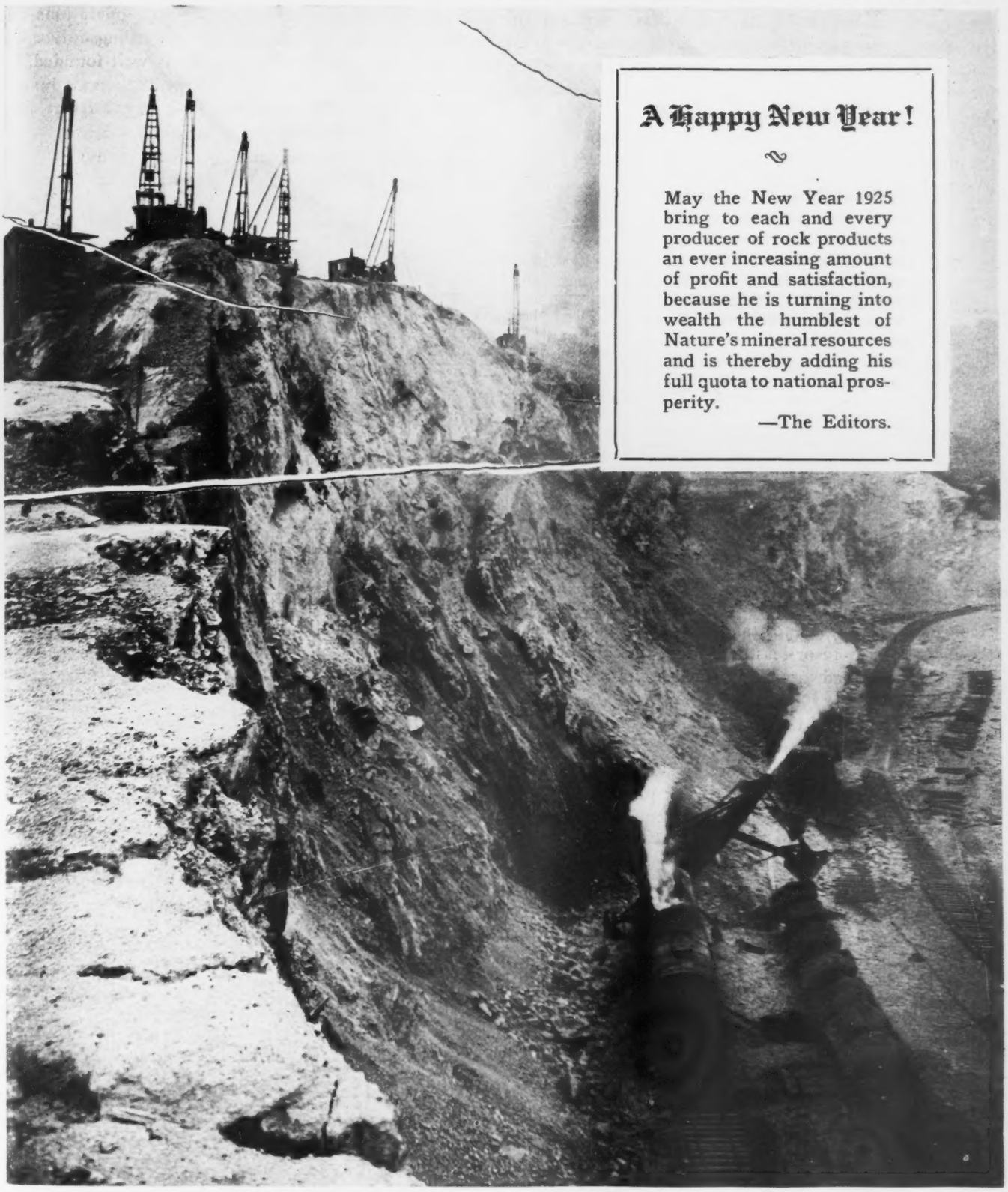


A Happy New Year!

May the New Year 1925 bring to each and every producer of rock products an ever increasing amount of profit and satisfaction, because he is turning into wealth the humblest of Nature's mineral resources and is thereby adding his full quota to national prosperity.

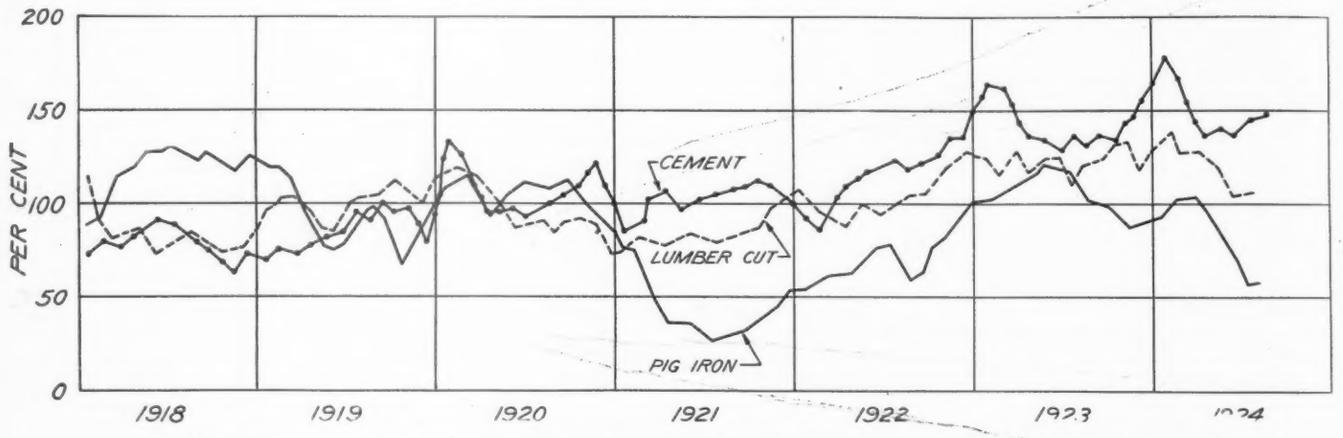
—The Editors.

Limestone quarry of the Tomkins Cove Stone Co., Tomkins Cove, N. Y., on the west bank of the Hudson river. (Keystone View Co. photograph)

Rock Products Building Material Industries Enjoy Banner Year—Others Not So Good

WHEN a great basic building material like portland cement reaches a production within about 10% of the capacity of the producing plants it is a pretty good indication of a prosperous year for portland cement manufacturers and all the subsidiary industries which furnish the wherewithal for concrete construction. And such we find was the case in 1924.

If we take into account the unusually rainy season throughout the Central West territory, the drop in pig iron and lumber production—the two great competitive materials—we can appreciate better the tremendously strong position of the portland cement industry and of the industries more or less dependent on concrete construction—the sand, gravel, crushed stone and slag industries.



Monthly production of major basic construction materials—seasonal variation allowed for (computed trend of past years = 100 per cent

Those branches of the rock products industry which are not dependent on general construction did not fare so well. There was a considerable slump in flux stone production; while production of rock phosphate, chemical lime, agricultural lime and limestone probably did not exceed, or about equaled, the 1923 production.

On the other hand, gypsum production for 1924 will probably show an increase over 1923 production of at least 25%—being the highest percentage of increase of any of the rock products.

So considering the low production of coal and all other minerals, and the stagnation in agriculture, it will be seen that the rock products industries, even with these handicaps, fared exceedingly well and far above the average of all industry.

With an outlook for 1925 at least as good as 1924, with the handicap removed from agriculture and with the prospect of one of the biggest years on record in railway development and improvement work, we believe producers in the rock products industries have every reason for optimism.

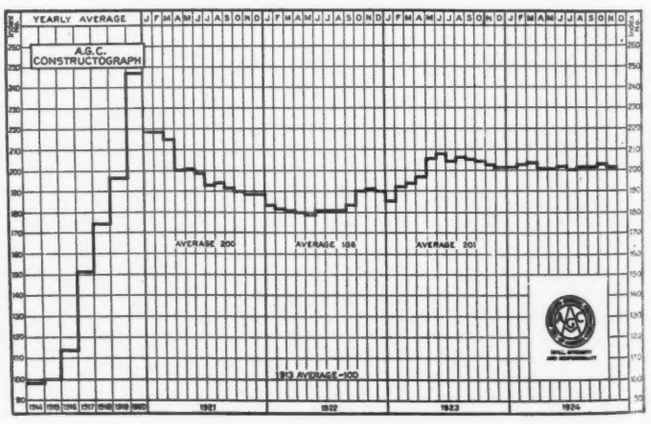
Yet it is one of the most healthful signs of all, that producers at this time of unparalleled optimism are mainly concerned with perfecting their operations and reducing costs and are cautious regarding future expansion. We believe this concern is well founded, for there are many factors which will limit industrial expansion other than a possible shortage of materials, among the most important of which is the prospective labor situation in the building trades and elsewhere.

Already building mechanics in the great cities are showing a disposition to demand further increases in their wages; and the railways are facing demands for higher wages which may eat into surpluses that would otherwise be expended for track and structures.

Again, the prospective revision of the freight-rate structure on all basic building materials is a deterring factor in present plant expansion.

But most of all is probably the feeling that we are

COST OF CONSTRUCTION



Graph plotted by the statistical department of the Associated General Contractors, showing stability of construction costs during past three years

experiencing more or less of a boom, which history shows will be followed by over-production in basic commodities and a period of sharper competition. There certainly is no immediate prospect of such a change in present conditions; but we believe the comparative stability of construction costs is at the bottom responsible for our present construction activity. Increased wages resulting in appreciably increased costs, or any considerable drop in present costs, would probably have the same effect in postponing contemplated construction.

From the expressed attitude of a great many producers of rock products, we feel sure that this situation is fully appreciated, and their belief that conditions in 1925 will show little change from 1924 conditions is father to the wish that others "will let well enough alone."

Production Records in 1924

Because of the monthly statistical service of the U. S. Geological Survey we are able to estimate the production of portland cement in 1924 at 148,000,000 barrels, which certainly is within 1,000,000 of being correct. In the case of the other rock products our estimates are very likely not so accurate, as we have little but percentage estimates of 1923 production to guide us.

Car loadings of sand, gravel and crushed stone compiled by the Car Service Division of the American Railway Association are shown below for both 1923 and 1924. The total car loadings in 1923 were in round figures 2,100,000 and the estimated figures for 1924 are 2,230,000. In other words, there were approximately 130,000 more carloads moved in 1924 than 1923. Figuring a carload at 40 to 50 tons, we have about 5,000,000 tons more production than in 1923, when the sand, gravel and crushed stone moved was probably in the neighborhood of 75,000,000 to 100,000,000 tons. The increase shown is therefore about 5%.

A year ago we estimated that approximately two-thirds of the material moved by rail was sand and gravel, the other one-third being stone. We estimated that approximately the same tonnage of sand and gravel was moved by water and by motor tucks. This gave a production of sand and gravel for 1923 of 150,000,000 tons. U. S. Geological Survey estimates for 1923 later gave 140,000,000 tons, so we are safe in stating that our estimates a year ago were pretty fairly correct.

This year (1924) car loadings are not so good an index of production because we know that a large increase in production in the East was all water-borne traffic. We believe, therefore, that the production of sand and gravel during 1924 was approximately 10% better than 1923, or the total production was in the neighborhood of 154,000,000 tons.

It is doubtful if crushed stone showed quite the same percentage, for this production is ordinarily about equally for railway ballast, highway stone and concrete aggregate. Limestone flux production was approximately 100,000 cars or about 20% less than 1923. In the East and in Illinois and Indiana the crushed stone business was best. Elsewhere it is doubtful if 1923 production was exceeded by much more than 5% in 1924. The U. S. Geological Survey recent figures for crushed stone production in 1923 show a total production of 88,000,000 tons, of which 25,000,000 tons was flux stone. In 1923, about 51,000,000 tons of crushed stone were used for road metal and concrete aggregate and approximately 11,000,000 tons for railway ballast (this was less than a normal year).

Of these items in 1924, flux production was probably about 20,000,000 tons; road metal and concrete aggregate about 60,000,000 tons and railway ballast about the same, or not over 12,000,000 tons. This gives a total estimated production of 92,000,000 tons for 1924, or approximately 5% more than 1923.

Lime production in 1924 was probably about the same as 1923. It is possible that it was 3 to 5% more. However, the lime industry in many sections was not so flourishing in 1924 as it was in 1923, owing to a slacking in the demand for chemical lime.

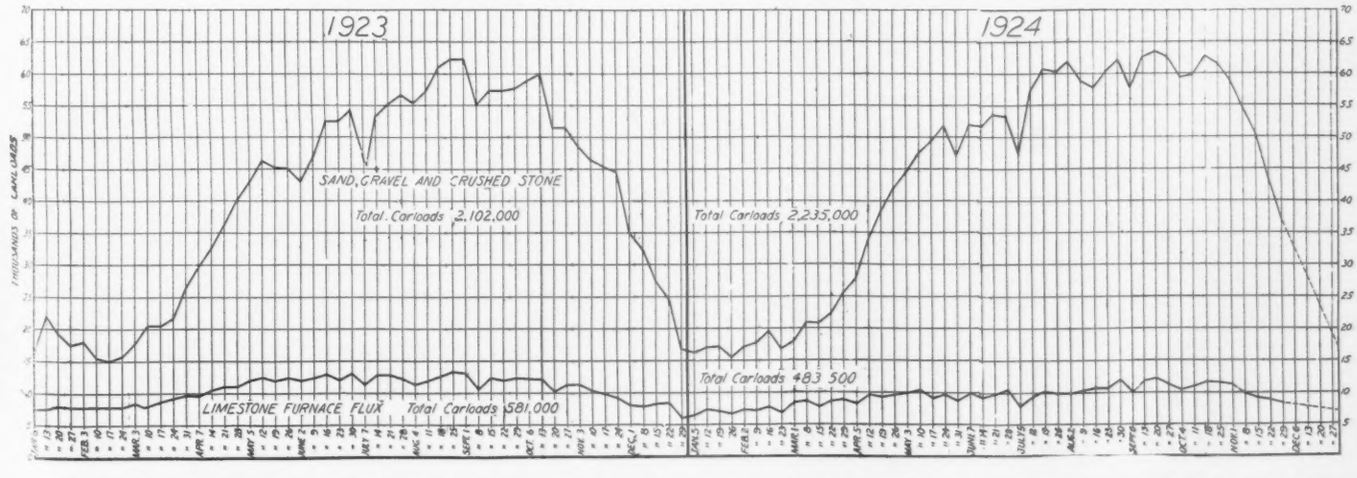


Chart of car loadings of sand, gravel and crushed stone (and below limestone flux) from figures compiled by the Car Service Division of the American Railway Association

Review of the Cement Industry in 1924

Estimated Production of 148,000,000 Barrels Makes Record Year

THE statistics of the United States Geological Survey, herewith, give an accurate analysis of the portland cement industry during 1924 to December 1. Assuming that the production for December is approximately the same as for the same month a year ago, the production of portland cement for the year just closed is the record-breaking figure of 148,000,000 bbl.

Yet, as was pointed out in an editorial analysis of the portland cement industry in ROCK PRODUCTS, August 23, 1924, new plants completed this year have given the industry a total capacity of approximately 165,000,000 bbl. or between 10 and 12% above the 1924 production. New plants and plant additions in the process of construction at present will add at least as large a percentage to the increased capacity of the mills in 1925. There is therefore a widening margin between actual production and possible production. Nevertheless, in *some* localities plants were pushed to the utmost capacity during 1924. This was more especially the case in the East, South and Central West sections. In the Northwest and on the Pacific coast portland cement production did not exceed and in some instances was less than in 1923. In the Northwest this was because of the stagnation of business in general, but on the coast the demand and consumption increased—and was filled in considerable measure by imported cement.

The outlook for 1925 in the portland cement industry is for about a 10% increase in production—about the same as 1924. There is no prospect of lower wages or lower prices. There is no present labor shortage and none is generally anticipated, although some express doubt as to labor conditions in 1925.

Considerable new outside capital entered the industry in 1924, but unquestionably a great deal more was expended for new plants and plant additions by old established producers. Among the notable new plants built by newcomers in the field are the Hermitage at Nashville, Tenn. (ROCK PRODUCTS, April 19, 1924); the Pittsburgh Plate Glass Co., Zanesville, Ohio (May 3, 1924); Henry Ford's plant at Detroit, Mich (August 9, 1924); the Manitowoc at Manitowoc, Wis. (September 6, 1924). The state of South Dakota has practically completed its 2000-bbl. plant at Rapid City, S. D.

The most notable new plant completed during the year by the older companies is that of the Pacific Portland Cement Co., Consolidated, at Redwood City, Calif. (November 29, 1924). Other old established producers who have new plants in various stages of completion are the Southwestern at Osborn, Ohio; the Wabash at Osborn, Ohio; the Trinity at Fort Worth, Texas; the Cement Securities Co. at Garnett, Okla.; the International at South Norfolk, Va.; the Clinchfield near Macon, Ga.; the Peerless at Detroit, and the Phoenix at New Orleans. Other projects that seem quite certain to materialize in 1925 are the plants of the Linwood Cement Co., Davenport, Iowa, the New England Portland Cement and Lime Co., Rockland, Maine, and the Bath Portland Cement Co. at Bath, Penn. We have records of about 24 other projects which may or may not materialize, but upon which, apparently, some promotional work has been done.

Plants Under Construction

The most interesting of the new plants under construction is undoubtedly that of the Southwestern at Osborn, Ohio. The Southwestern has now two well-known plants in operation, a wet-process plant at Victorville, Calif., and a dry-process plant at El Paso, Texas. The new Ohio plant at Osborn will be modeled more or less after the Victorville plant, but will contain a lot of new ideas that President Carl Leonardt has gathered from all corners of the world. It will be the first *all-concrete* cement plant in the East and, according to all accounts, will be the most spectacular plant in the industry. Some notes and progress pictures of it are given elsewhere in this issue.

All new plants building or contemplated, so far as we can determine, are wet-process. And one of the most striking developments of the past year has been the conversion of some of the best known dry-process plants to the wet-process. A notable example of this is given in quite some detail in the following pages. This conversion of the Glens Falls plant is of considerable significance since here a natural cement rock, very similar to the Lehigh Valley deposits, is the chief raw material.

Practically all of the producers reporting are of the opinion that capital expenditures next year may better be made to perfect operation and reduce production costs rather than in increasing production.

The outstanding development of the year, in the opinion of the majority of those reporting, was the beginning in this country of the manufacture of high alumina cements by the Atlas Lumnite Cement Co. Producers are rather reluctant to express opinions as to the ultimate effect on portland cement manufacture of the introduction of special cements in American engineering practice; but it would seem that a problem of more immediate importance is the attainment of greater uniformity in present standard portland cement. To bring this about and to perfect and cheapen costs of production, some producers believe, offers inducements to more high grade technical men at the plants.

Portland Cement Statistics To and Including November

THE following tables, prepared under the direction of Ernest F. Burchard, of the Geological Survey, are based mainly on the reports of producers of portland cement but in part on estimates. The estimates for November, 1924, were made necessary by the lack of returns from two plants. Production and shipments show seasonal decreases but both are greater than in 1923; stocks are 28 per cent higher.

Stocks of clinker, or unground cement, at the mills at the end of November, 1924 amounted to about 4,023,000 bbl. compared with 3,548,000 bbl. (revised) at the beginning of the month.

Imports and Exports

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in October, 1924, amounted to 211,228 bbl., valued at $331,506. The total imports in 1923 amounted to 1,678,636 bbl., valued at $2,964,098.

The imports in October were from Belgium, 125,309 bbl.; Norway, 49,960 bbl.; Denmark, 13,768 bbl.; Canada, 11,986 bbl.; Philippine Islands, 3,819 bbl.; Germany, 3,247 bbl.; Mexico, 2,788 bbl.; other countries, 351 bbl.

The imports were received in the following districts: Los Angeles, 52,235 bbl.; Philadelphia, 37,562 bbl.; Florida, 32,557 bbl.; Washington, 23,871 bbl.; San Francisco, 17,872 bbl.; Porto Rico, 15,841 bbl.; New Orleans, 9,246 bbl.; Vermont, 8,108 bbl.; Hawaii, 5,899 bbl.; Massachusetts, 2,508 bbl.; other districts, 5,529 bbl.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN NOVEMBER, 1923-1924, AND STOCKS IN OCTOBER, 1924, IN BARRELS

Commercial District:	Production—November 1923	Production—November 1924	Shipments—November 1923	Shipments—November 1924	Stocks at end of November 1923	Stocks at end of November 1924	Stocks at end of October, 1924*
Eastern Pa., N. J., Md.	3,139,000	3,376,000	2,984,000	2,845,000	1,230,000	1,207,000	677,000
New York	677,000	655,000	559,000	523,000	498,000	511,000	379,000
Ohio, Western Pa., W. Va.	1,262,000	1,277,000	830,000	932,000	591,000	817,000	472,000
Michigan	780,000	928,000	488,000	581,000	469,000	629,000	282,000
Wis.,† Ill., Ind., Ky.	1,809,000	1,894,000	1,287,000	1,278,000	795,000	1,052,000	436,000
Va., Tenn., Ala., Ga.	831,000	1,095,000	806,000	1,070,000	293,000	314,000	290,000
Eastern Mo., Iowa, Minn.	1,345,000	1,313,000	758,000	782,000	1,211,000	2,034,000	1,502,000
Western Mo., Neb., Kan., Okla.	921,000	943,000	800,000	737,000	818,000	1,078,000	872,000
Texas	348,000	384,000	320,000	358,000	254,000	242,000	215,000
Colorado and Utah	231,000	194,000	171,000	134,000	234,000	241,000	181,000
California	1,052,000	887,000	1,079,000	890,000	284,000	361,000	364,000
Ore., Wash., Mont.	208,000	195,000	169,000	159,000	314,000	439,000	403,000
	12,603,000	13,141,000	10,251,000	10,289,000	6,991,000	8,925,000	6,073,000

*Revised. †Began producing, June, 1924.

The exports of hydraulic cement in October, 1924, were 79,180 bbl., valued at $253,479, of which there were sent to South America, 29,075 bbl.; Cuba, 25,685 bbl.; to the other West Indies, 2,940 bbl.; Mexico, 9,183 bbl.; Central America, 8,104 bbl.; Canada, 590 bbl.; and to other countries, 3,603 bbl. These exports are exclusive of shipments to the following possessions: Porto Rico, 5,050 bbl.; Alaska, 3,269 bbl.; Hawaii, 1,120 bbl.

The statistics of imports and exports of hydraulic cement in November, 1924, are not available.

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped for the period from July to September, 1924. It is planned to publish in succeeding issues of this report similar figures for succeeding months and also for the preceding months back to October, 1923, when these figures are available.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1923-1924, IN BARRELS

Month	Production 1923	Production 1924	Shipments 1923	Shipments 1924	Stocks at End of Month 1923	Stocks at End of Month 1924
January	7,990,000	8,788,000	5,628,000	5,210,000	11,477,000	14,155,000
February	8,210,000	8,588,000	6,090,000	5,933,000	13,596,000	16,815,000
March	9,880,000	10,370,000	10,326,000	8,995,000	13,045,000	18,189,000
First quarter	26,080,000	27,746,000	22,044,000	20,138,000		
April	11,359,000	11,726,000	12,954,000	12,771,000	11,463,000	17,159,000
May	12,910,000	13,777,000	14,257,000	14,551,000	10,144,000	16,403,000
June	12,382,000	13,538,000	13,307,000	15,036,000	9,168,000	14,903,000
Second quarter	36,651,000	39,041,000	40,518,000	42,358,000		
July	12,620,000	14,029,000	13,712,000	16,614,000	8,081,000	12,319,000
August	12,967,000	15,128,000	14,971,000	16,855,000	6,080,000	10,666,000
September	13,109,000	14,519,000	13,698,000	16,827,000	5,533,000	8,404,000
Third quarter	38,696,000	43,676,000	42,381,000	50,296,000		
October	13,350,000	14,820,000	14,285,000	17,081,000	4,612,000	*6,073,000
November	12,603,000	13,141,000	10,251,000	10,289,000	6,991,000	8,927,000
December	9,997,000		6,408,000		10,900,370	
Fourth quarter	35,950,000		30,944,000			
Preliminary total	137,377,000		135,887,000			
Amount of under estimate	83,238		25,118			
Final total	137,460,238		135,912,118			

*Revised.

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1923-1924, IN BARRELS*

Month	Imports 1923	Imports 1924	Exports 1923	Exports 1924
January	71,686	153,732	74,169	88,586
February	20,529	162,930	88,531	62,606
March	66,521	160,517	98,861	91,224
April	76,899	148,138	85,662	83,200
May	88,480	161,304	103,634	88,850
June	111,559	196,655	77,203	74,064
July	286,106	109,098	82,774	60,139
August	324,008	192,634	73,201	85,883
September	215,785	134,245	77,121	69,470
October	172,051	211,228	74,302	79,180
November	140,590	(†)	85,743	(†)
December	104,422		80,487	
	1,678,636		1,001,688	

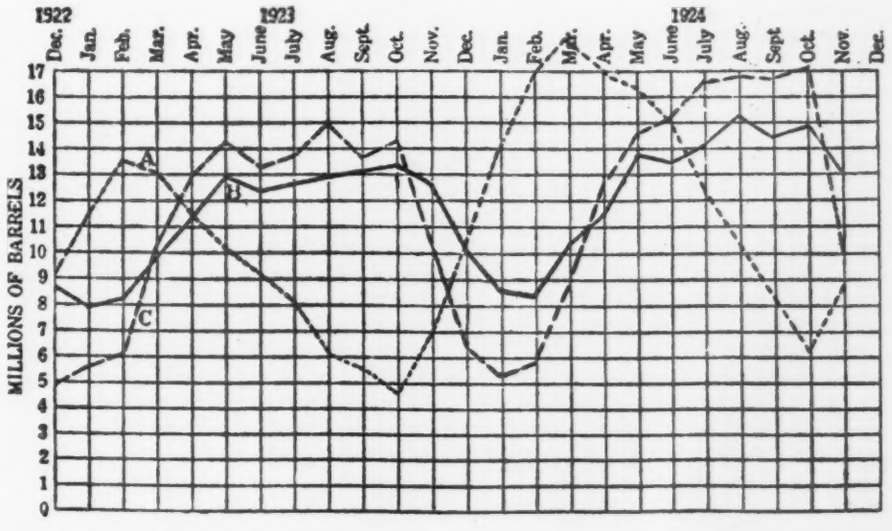
*Compiled from records of the Bureau of Foreign and Domestic Commerce.

†Imports and exports in November, 1924, not available.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, BY MONTHS, JULY-SEPTEMBER, 1924*

Shipped to—	Barrels July	Barrels August	Barrels Sept'ber
Alabama	212,720	185,494	167,959
Alaska	1,432	1,053	1,846
Arizona	30,474	32,615	39,176
Arkansas	129,334	139,515	114,134
California	942,273	960,221	936,834
Colorado	161,005	174,924	150,865
Connecticut	192,957	179,012	193,380
Delaware	46,078	49,501	52,272
Dist. of Columbia	79,851	80,080	79,399
Florida	173,184	198,827	220,021
Georgia	107,824	134,819	151,930
Hawaii	5,451	1,842	2,076
Idaho	23,922	28,042	30,221
Illinois	1,533,330	1,404,542	1,584,579
Indiana	744,692	781,376	764,188
Iowa	401,855	357,329	461,405
Kansas	199,437	228,297	228,064
Kentucky	188,068	203,792	222,361
Louisiana	109,385	104,683	116,770
Maine	50,045	48,807	41,945
Maryland	218,371	256,498	230,946
Massachusetts	388,173	369,062	364,320
Michigan	1,205,309	1,252,561	1,263,113
Minnesota	405,863	392,542	397,268
Mississippi	41,506	60,512	59,499
Missouri	427,101	435,736	501,596
Montana	20,985	26,332	24,935
Nebraska	158,955	178,020	204,610
Nevada	8,806	9,847	12,815
New Hampshire	41,240	46,592	37,872
New Jersey	738,895	712,602	756,579
New Mexico	22,007	24,153	29,306
New York	2,041,145	1,966,885	1,953,647
North Carolina	259,730	383,174	295,252
North Dakota	72,154	33,148	24,990
Ohio	1,211,851	1,164,939	1,059,982
Oklahoma	177,823	193,464	185,550
Oregon	140,656	153,691	141,492
Pennsylvania	1,580,596	1,737,633	1,672,054
Porto Rico			
Rhode Island	60,649	63,326	70,196
South Carolina	42,238	50,890	52,416
South Dakota	70,244	53,360	60,159
Tennessee	148,173	176,909	196,000
Texas	388,590	379,845	308,305
Utah	55,413	41,539	47,993
Vermont	35,469	46,512	36,842
Virginia	156,644	189,686	184,713
Washington	179,521	208,254	175,169
West Virginia	226,563	207,811	191,320
Wisconsin	586,677	551,562	603,204
Wyoming	47,769	46,597	38,828
Unspecified	66,488	73,614	37,101
	16,558,921	16,782,067	16,777,497
Foreign countries	55,079	72,933	49,503
Total shipped from cement plants	16,614,000	16,855,000	16,827,000

*Includes estimated distribution of shipments from five plants in July; from four plants in August and September.



(A) Stocks of finished portland cement at factories. (B) Production of finished portland cement. (C) Shipments of finished portland cement from factories

Panorama of the quarry of the Glens Falls Portland Cement Co. at Glens Falls, N

The Glens Falls Portland Cement Co. Plant

Dry to Wet Process Without Interruption of Production

WE have mentioned, in our review of the portland cement industry during 1924, the marked tendency toward the practically unanimous adoption of the wet process of manufacture. An outstanding example of the conversion of a well-known dry process plant to a modern wet-process plant is the Glens Falls Portland Cement Co. of Glens Falls, N. Y.

The original plant was described in some detail in the June 19, 1920, number of Rock Products as an example of dry-process plants which had worked out a raw-material control method which left little to be gained by adoption of the wet-process. Nevertheless, in modernizing this plant and adding to its capacity it was deemed best to convert it entirely to the wet process.

The change is all the more interesting to the American portland cement industry because the conditions surrounding the plant and the raw materials it uses are in most respects very similar to those of the Lehigh Valley plants in New Jersey and Pennsylvania, which are and always have been the strongholds of the dry-process manufacturers.

The Quarry at Glens Falls

The quarry and crushing plant are on the south side of the Hudson river, the cement mill on the opposite bank. The quarry has a considerable face of low-limed natural cement rock similar to the Lehigh Valley deposits. The process of preparing the raw materials—adding high calcium rock to the cement rock—is practically the same as that used at Lehigh Valley plants. The Glens Falls operation, however, has the advantage over some of the Lehigh plants of having a high calcium rock in the same quarry.

G. F. Bayle, Jr., vice-president of the Glens Falls Portland Cement Co.

The exposed quarry face shows approximately the following stratification from top to bottom, according to J. B. Dixon, chemist, who has actual supervision of quarry operations: 3 ft. of clay; 15 ft. of low limed cement rock, containing pyrites, locally known as "slate" because of its black color —it is about 68% $CaCO_3$; 40 ft. of low-limed cement rock ranging from 68 to 78% $CaCO_3$, in comparatively thin layers; 50 ft. of high-limed cement rock, ranging from 77 to 82% $CaCO_3$, and 30 ft. of fairly pure high calcium rock, ranging from 91 to 96% of $CaCO_3$.

The quarry is operated in two main levels, the lower level extending through the 30 ft. of high calcium stone about 20 ft. above into the high calcium cement rock, over which is the upper level ranging from high-lime cement rock to the clay overburden.

On account of the wide and frequent fluctuations of the material from the two upper shovels, no attempt is made to make the mix in the quarry, but the shots on the upper level and the loading positions of the electric caterpillar shovel on the lower level are planned so that the output of the quarry for a period (usually a week or 10 days) will be definitely higher or lower than the correct composition figure.

This output is accumulated in the stone storage building in two piles, high and low, and fed to the raw mill by an electric crane.

In order to blend these to a correct mix, high stone is run into the raw mill until a correcting tank is filled with high-lime slurry, then low stone until a low one is filled. These are calculated to the proper $CaCO_3$ proportion, dumped into the mixing basin, stirred, checked up and pumped to the kiln storage tank. This system of accumulating a tank of high slurry, then changing to a low slurry until the high is blended, and a surplus of low is accumulated

Falls, N. Y., from which come all of the raw materials for its cement mill

to be corrected by the next alternation of high, is the best method of making a cement mix where the quarry stone cannot be relied upon to remain definitely either high or low at all times.

Any other system requires the separate maintenance of wash mill and tanks for clay corrections, and a limestone bin or high slurry tank for correcting low-lime stone when encountered.

With continuous eight-hour shifts of operations on raw mix testing and blending, material for 4000 bbl. daily is handled with three correcting tanks, one mixing basin and one storage tank for kiln supply. As the silica-alumina ratios are practically constant for all materials used, the mix is made up on a $CaCO_3$ basis only. The slurry record illustrated on page 75 covers the raw mill operation up to the kiln storage tank.

Plant Rebuilt Under Operating Conditions

The sequence of the work of changing over the plant from dry to wet process without disturbing the operation was as follows:

The clinker and rock storage building was put in and completed during 1922. The new machine shop was completed during 1922 and the change from dry to wet process was completed early this spring, 1924.

The two news kilns (9x10x250 ft.) were placed east of the four old kilns and did not cause any interference with operation.

As far as the raw mill is concerned, the old building was originally designed for Griffin mills and stone and clay dryers. The Griffin mills were replaced 15 to 20 years ago by tube mills and kominuters. However, the building as originally built is so spacious that it was possible to put in the new kominuters and tube mills for wet grinding without interfering with the operation of the kominuters and tube mills working on dry raw materials.

All the four old kilns (two are 7x120 ft. and two 7x7½x120 ft.) were kept operating on dry materials until the two new kilns were placed in operation and operating with slurry; then the four old kilns were successively shut down, one at a time, to have the interior adapted to the wet process. In this way it was possible to keep the mill in operation without loss of output.

As has occurred in similar instances, in changing from the dry to the wet process, the amount of floor space saved in the raw-grinding end was very considerable. At the Glens Falls plant the new raw-material grinding installation occupies only about 43% of the floor area of the old building, including a fourth kominuter, which is shown on the plan in dotted lines, at the east end of the building. This fourth unit brings the plant capacity to 4200 bbl. a day, as compared with a maximum grinding capacity of 2400 bbl. with the old dry-process equipment, occupying about 67% of the total floor area.

The two tube mills shown in dotted lines on the plan on page 74 indicate two of the old dry-grinding tube mills, which have been removed. One has been converted and is installed as a wet-grinding tube mill, and the other has been installed in the clinker-grinding department. The other tube mills from the old dry-grinding departments will also be added eventually to the clinker-

Crushed stone storage at the end nearest and clinker storage at the far end; hopper for feeding raw-grinding mills in left-hand foreground

Quarry car tipple in crushed-stone storage shed

grinding department, replacing some smaller mills which have been in service for 20 to 25 years.

Special Features of New Plant

Raw material and clinker are now stored under one roof, the clinker at the end nearest the mill, and raw material at the other end. This building is 272½ ft. long and 75 ft. wide by 33 ft. clearance under the crane. It is built of reinforced concrete and is divided transversely by a partition. The east end supplies storage room for 16,000 tons of crushed stone, and the west end when full contains clinker for 60,000 bbl. of cement.

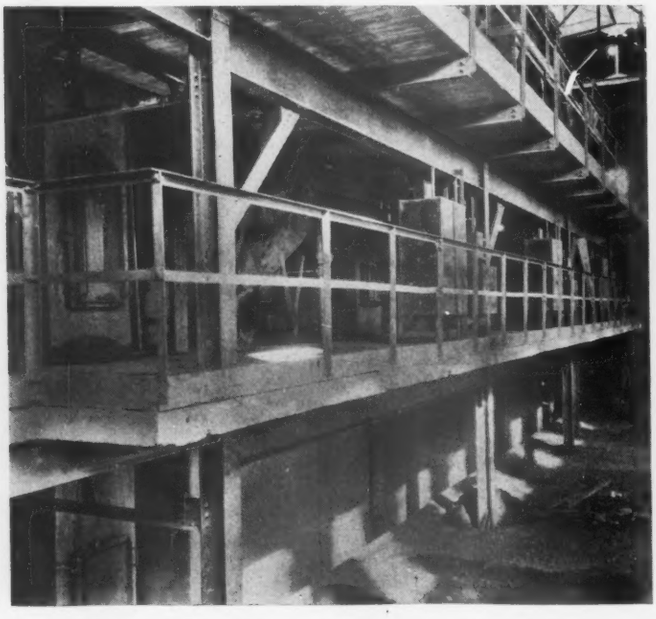
The quarry cars are hauled up an incline at the east end of this storage shed by cable and are end-dumped by means of a specially designed tipple at the top of the incline. The rock is picked up at the foot of the dump by a clamshell operated from a Cleveland traveling crane and dumped either on the high or low lime pile, or into a concrete hopper feeding a 24-in. belt conveyor. The belt conveyor discharges into a 24-in. Peck carrier, which passes entirely around the battery of No. 85 kominuters, and feeds the bins of any unit at the will of the operator.

About 30% of water is mixed with the raw material as it is fed into the kominuters. Each kominuter discharges to an elevator which feeds a Trix separator above, operated in closed circuit with the kominuter, the Trix rejections going back to the kominuter. The Trix separator is set to make rejections at No. 20 mesh. The discharge of the battery of Trix separators goes to a common screw conveyor, which feeds the finish tube mills, which are driven by three 300-hp. G.-E. super-synchronous motors. This part of the plant is a typical installation according to the standard, modern, wet-process plant as developed by F. L. Smidth & Co., the designers and engineers.

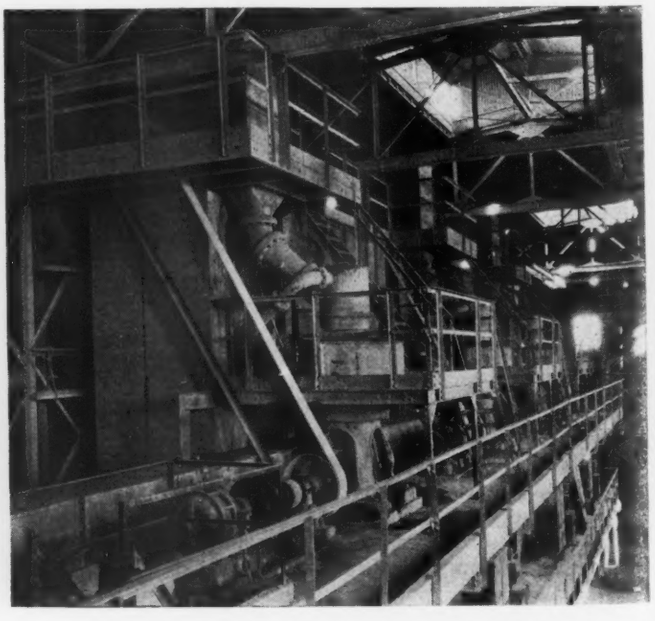
The Trix separators are each driven by a direct-connected 10-hp. General Electric motor, running at 570 r.p.m., through Jones flexible couplings and a Jones speed reducer, single type, ratio 4.22:1. The same shafts carry pulleys which drive the elevators through 8-in. belts. The kominuters are "silent-chain" driven by individual 125-hp. G.-E. squirrel-cage motors running at 575 r.p.m.

The slurry from the tube mills is pumped to three concrete correcting basins, about 20 ft. in diameter and 15 ft. deep, holding slurry for 500 bbl. of cement each. These slurry basins are the F. L. Smidth & Co. standard, mechanically agitated by rotating paddles driven by bevel gears from a single line shaft, direct-connected through a Jones speed reducer, double type, ratio 28½:1 to a 25-hp. G.-E. motor at 1160 r.p.m. There is in this case only two types of slurry to be dealt with—the high lime and the low lime—so that any two of them, tapped in the right proportions, will give the proper mix for the kilns.

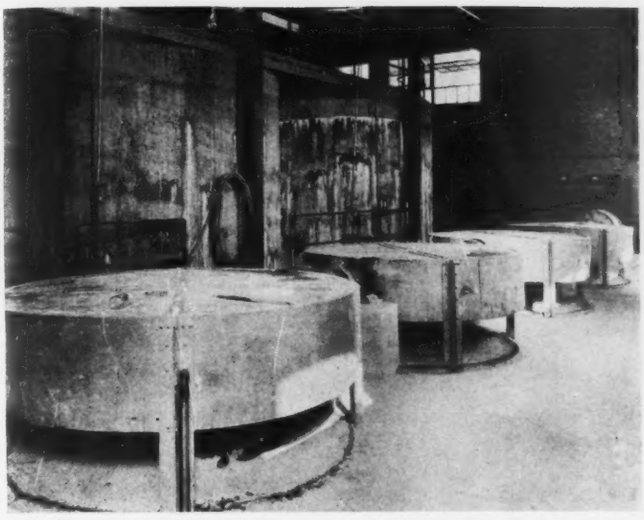
The correcting tanks empty by gravity into one mixing basin 51 ft. long by 20 ft.



Battery of kominuters in old raw-grinding building



Trix separators showing direct-motor drives



Two of the three correcting tanks above and the large mixing tank below, showing screened drives of agitation

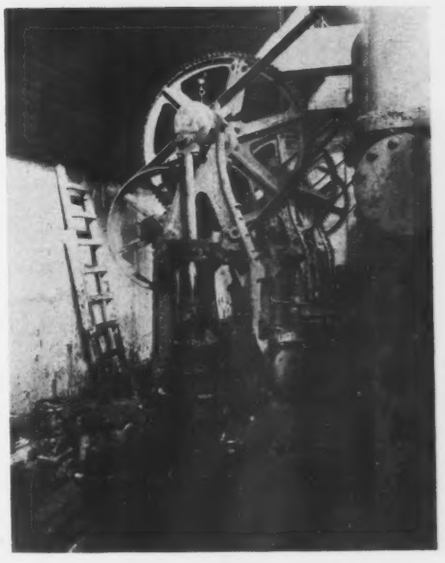
General view of new kiln building and new concrete stack; the old stacks are shown in the background

General view of plant from quarry approach

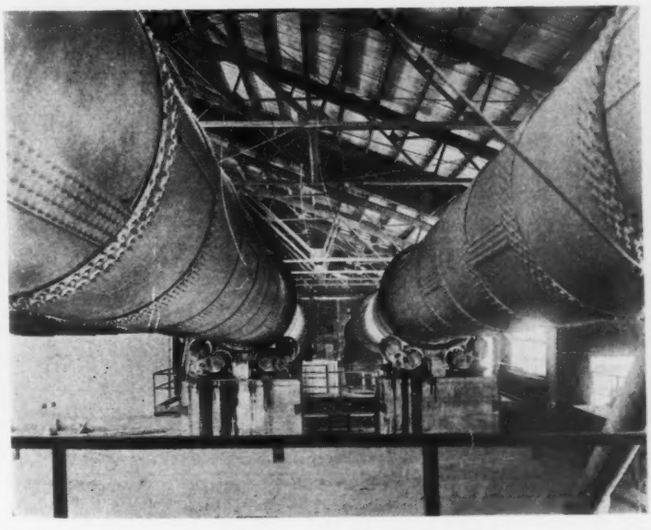
wide and 17 ft. deep, holding slurry for 1700 bbl. of cement. From this mixing, or collection tank, the slurry is pumped by Ingersoll-Rand Co.'s air-lift pumps to an open storage basin under the two new kilns. This basin is 25 ft. wide by 125 ft. long by 21 ft. deep and holds sufficient slurry for 7350 bbl. of cement, or nearly two days' run of all the kilns.

The unique feature of this slurry system is the size, location, and method of agitation of the slurry storage tank. It is the first of its kind in an American cement plant.

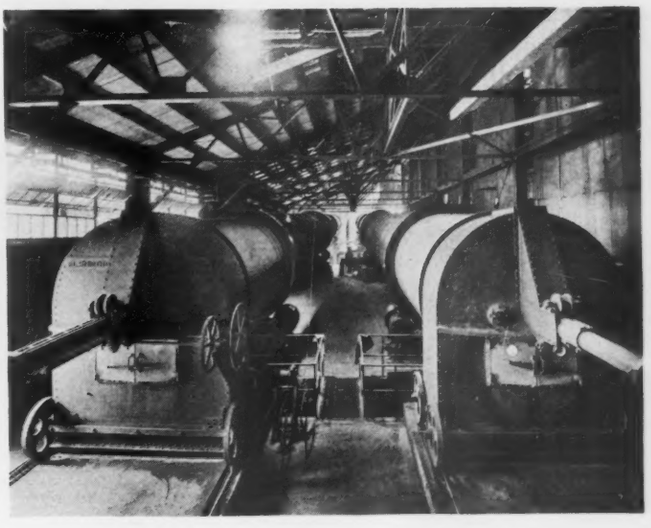
The agitation of the slurry is accomplished by a traveling agitator with rotating paddles and compressed air outlets, as illustrated in two of the accompanying views. The employes of the cement company have named this traveling agitator "The Toonerville Trolley," typifying its slow speed of 935 ft. per hour or 15 minutes for a round trip. It is powered with two G.-E. motors, one 10-hp. motor operating the agitating arms



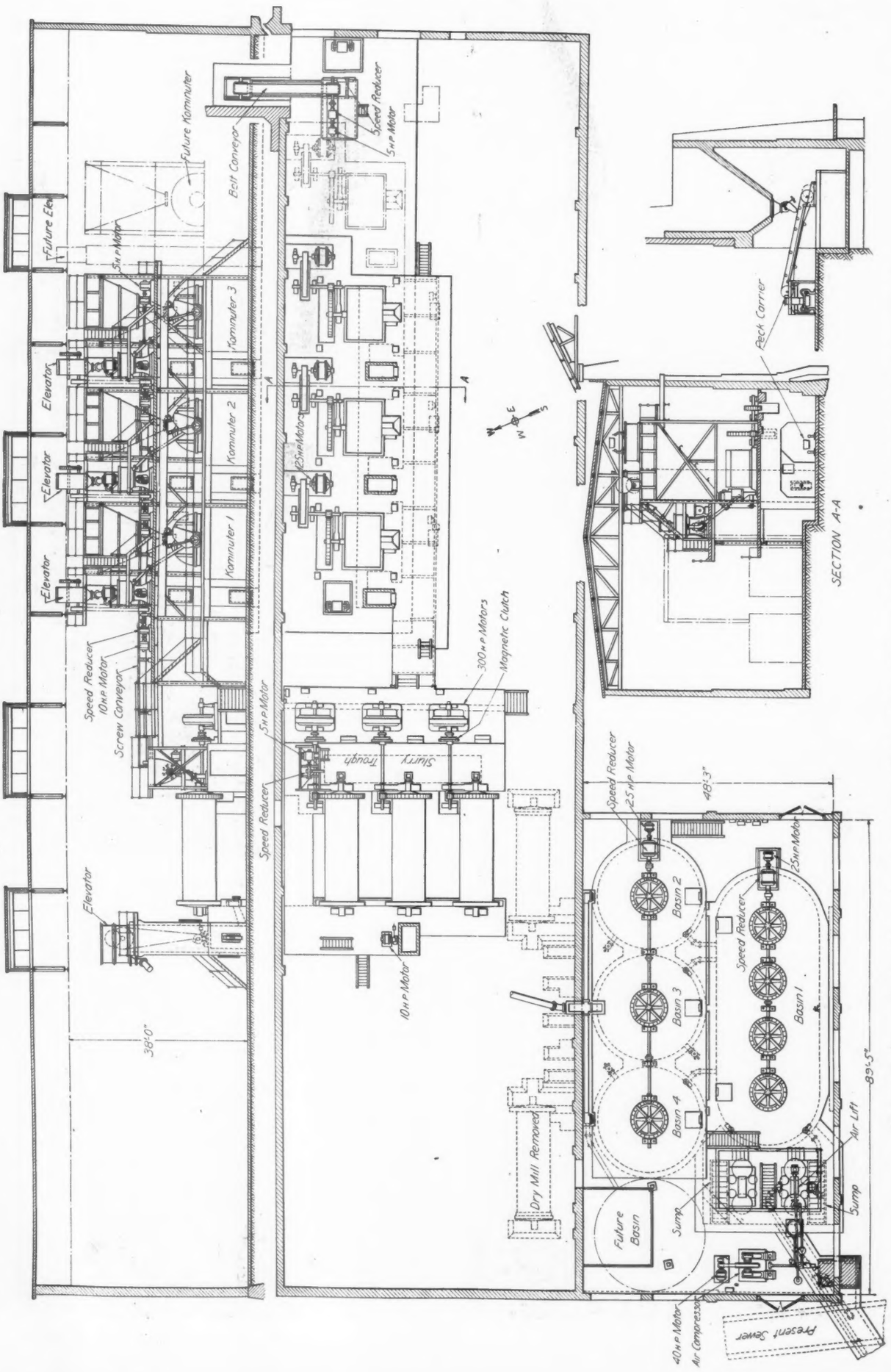
High-pressure slurry pumps for filling kiln-feed troughs



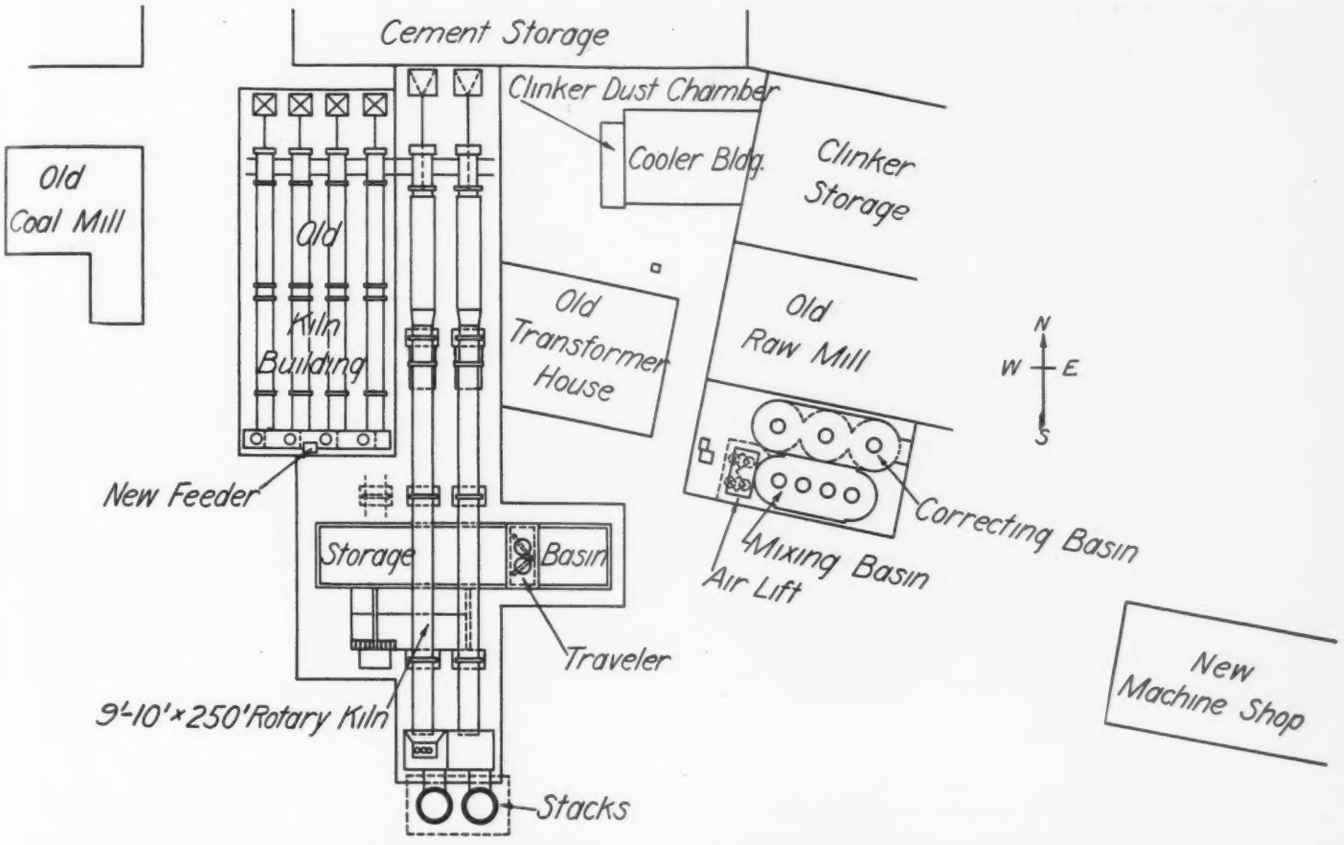
Two new 9x10x250-ft. kilns



Special hoods and burner tips of new kilns



General plan and elevations of new raw-grinding units and slurry tanks of the Glens Falls Portland Cement Co.



General plan showing setting of new kilns and relation of various units

GLENS FALLS PORTLAND CEMENT COMPANY

As Correction_____ Slurry Record_____19____

		KOMINUTER FEED	TUBE MILL PRODUCT				SAMPLE TANKS FILLED									TANKS DUMPED			TRIX							
	HOUR		Water	As No.	CaCo3	No. 200 Fine	Tank	Operator	From	To	Inches	PERCENTAGE Water	As No.	CaCo3	No. 200 Fine	36.2 Inches	CU FEET	Bbls.	Hour	Inches	PERCENTAGE Water	As No.	CaCo3	No. 200 Fine	CU FEET	Bbls.
	7 A. M.																									
	8 A. M.																									
	9 A. M.																									
	10 A. M.																									
	11 A. M.																									
	12 A. M.																									
	1 P. M.																									
	2 P. M.																									
	3 P. M.																									
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	3 A. M.																									
	4 A. M.																									
	5 A. M.																									
	6 A. M.																									
	TOTAL																									
	AVG.																									

(78.8) MIXING BASIN

(388.4) KILN TANK

SAMPLE TANKS—From Last Sheet

Form used to keep record of slurry mixtures

Laboratory of the Glens Falls Portland Cement Co. J. B. Dixon, chemist, center

and one 5-hp. motor operating the bridge travel; the speed of both motors is 570 r.p.m.

The electric power cable from one end winds and unwinds automatically in the progress of the carriage forward and backward, and an air hose coupling winds and unwinds on the opposite side. The trolley automatically reverses every 7 minutes.

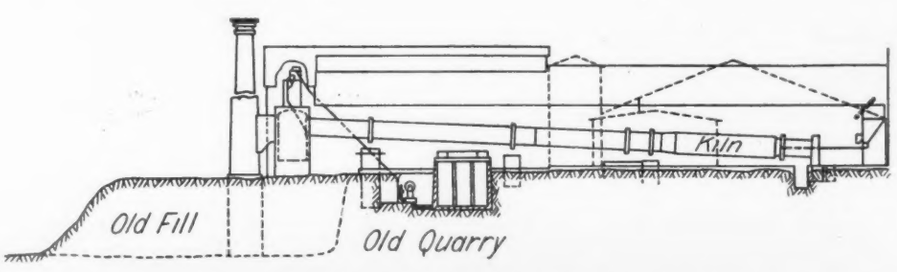
Adjustable Burner Tips on Kilns

This storage basin feeds both the new and the old kilns, the slurry being pumped to them by F. L. Smidth & Co. standard plunger slurry pumps. A constant rate of flow to the kilns is maintained in the ordinary way by means of weirs in the feed troughs, and the overflow is returned by gravity to the storage basin.

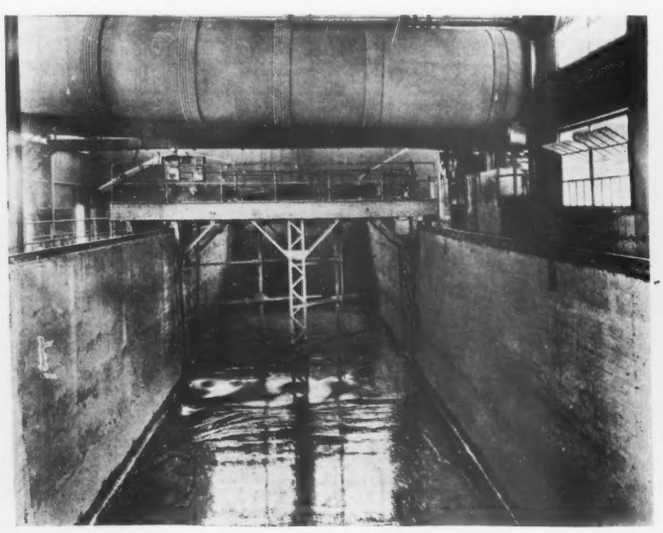
The new kilns are chiefly notable in being extended at the discharge end so that the lower sections of the kilns function in part as coolers, and in that way supply hot air for the combustion of the fuel. This required a special coal pipe arrangement providing for a movement of 4 ft. along the longitudinal axis of the kiln. This was found expedient in order to avoid changing the whole cooling system, in that two 7 ft. x60 ft. standard coolers had been installed two years previous to the change to the wet process and in connection with the new clinker storage building.

It may be interesting to mention that one of the results in changing from the dry to the wet process was found in that the wet process clinker gave approximately 33⅓% more capacity in the clinker grinding mills. This was readily ascertained, because the clinker mill has not yet undergone any changes, although it is the intention in the near future to have this part of the plant remodeled, particularly in respect to conveying and handling of the finished cement.

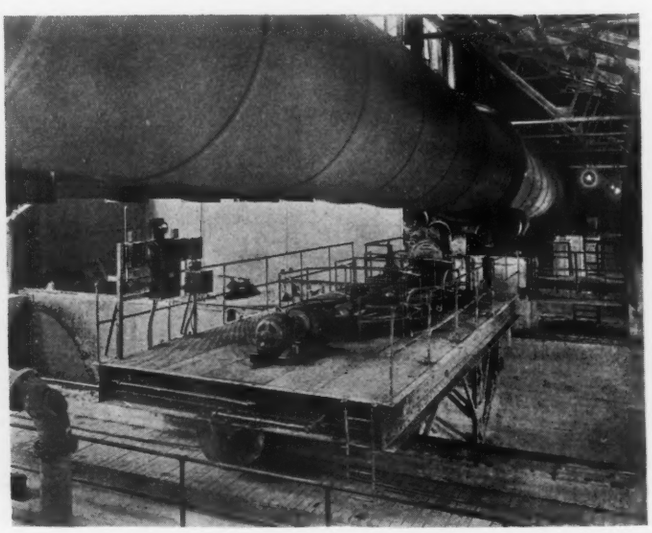
There are other changes and improvements at this plant, which in many ways make it one of the most modern and most notable cement plants in this country. But at the time the foregoing data were collected these changes were in progress and we shall have to reserve them for mention in a future issue. On the whole, these changes and improvements at the Glens Falls plant undoubtedly illustrate the beginning of the renovation and modernization of many similar plants particularly in the East, which have been left behind in technical progress by some of the newer mid-West plants. It is an excellent example of what may be done



Elevation showing relation of new kilns and slurry feed tank



Great slurry feed tank with traveling agitator



Trolley carrying machinery for agitating slurry

in the way of improvement and rebuilding without seriously interfering with steady production.

An additional complication was caused by the substitution of 60-cycle for 40-cycle purchased electric current, necessitating the renewal of all motors, and rebuilding the central transformers and switchboards. Continuous operation required this to be completed by stages and compelled the use of two separate systems of power transmission and utilization during the entire reconstruction period.

Personnel

As already noted, the designing and engineering of the new plant were done by F. L. Smidth and Co., New York, with O. E. Mogensen in direct charge, to whom we are indebted for much of the foregoing description.

P. T. Lindhard, of F. L. Smidth & Co., had much to do with the design. The construction work was supervised by F. P. Monaghan, superintendent of the Glens Falls Portland Cement Co., and all new machinery was installed by the cement company's mechanics.

The president and general manager of the Glens Falls Portland Cement Co. is Geo. F. Bayle; the first vice-president, Bryon Lapham; the second vice-president, Geo. F. Bayle, Jr.; the secretary, John E. Parry; the treasurer, A. W. Sherman; the purchasing agent, William H. Marshall. Jr.; the superintendent, F. P. Monaghan, and the chemist, J. B. Dixon.

A Concrete Cement Plant for Ohio

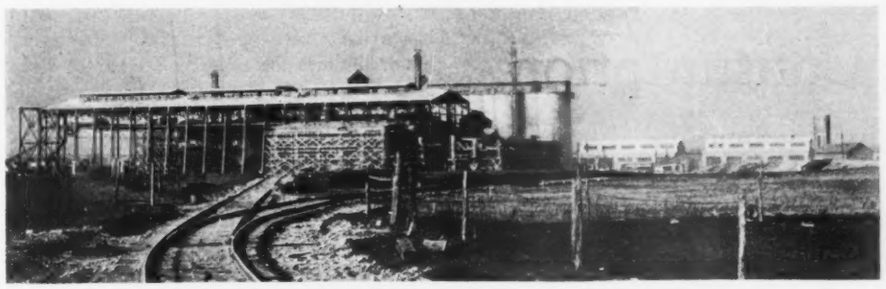
By George M. Earnshaw

CARL LEONARDT, president of the Southwestern Portland Cement Co., with the aid of General Manager Binford, Chief Engineer Rieth and Superintendent Wechlo, is certainly building a wonderful plant at Osborn, Ohio. There is no one, I am sure, who will deny that it is to be the very last word in cement plants. Mr. Leonardt has seen to it personally (and *is* seeing to it, for he is on the job every day), that the utmost precision and care are taken in its construction. While he is not out after a construction time record, nevertheless the short time required in building it will be remarkable, for it is today more than two-thirds completed, the work having been started in June.

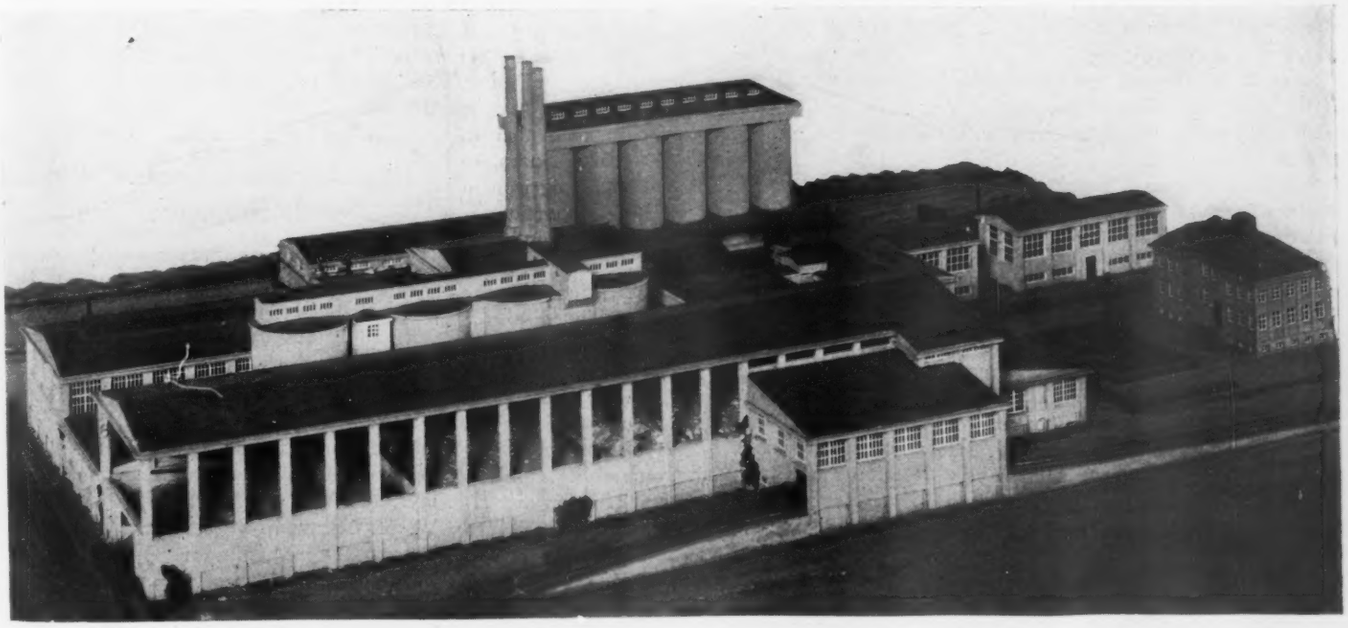
There are to be four kilns eventually, but at the beginning only three will be installed; two of these are already in position. Two of the waste-heat boilers are now in and the third was being erected at the time of my visit on December 11.

All the major concrete work is finished, excepting the walls of the finish-plant building, crusher-plant building and raw-plant building. The MacDonald Engineering Co. has practically completed the cement storage tanks, which will have a combined capacity of 250,000 bbl. Three large cylindrical tanks for clinker, with a capacity of 100,000 bbl., are completed, as well as the slurry tanks. An interesting feature, in connection with the clinker tanks, is the conveying system under them. This equipment resembles a pan conveyor to some extent, but its operation is in no way similar. It was imported from Europe by Mr. Leonardt and is the only installation of its kind in America, in any kind of plant. This feature, as well as many other innovations, will be described in Rock Products upon completion of the plant next spring.

The structural steel work of the stone storage building is completed, the corrugated cement-asbestos roof (with which all the buildings will be covered), is on, and the big 80-ft. span crane is mounted and ready for use. All the machinery is



New plant of the Southwestern Portland Cement Co. near Osborn, Ohio, as it looked recently



Model of the new Southwestern Portland Cement Co. plant as it will look when completed—a really model cement plant

on the job, while the major equipment is all set up. No expense was spared in equipping the machine shop, which was, of course, the first building erected and equipped. It is elaborate in its design, with plenty of working room, and the equipment is the most modern that Mr. Leonardt could find.

The work of opening the quarry was started during the latter part of November and already is in fair condition. It is a hillside proposition and is located about one-half mile from the plant and connected with it by standard-gaged track with a slight down grade toward the plant. Like the plant, the quarry is equipped with new and heavy equipment, including a 61-ton caterpillar-tread steam shovel, a 52-ton locomotive, 12-yd. dump cars and large blast-hole drill.

No exact date has been set for this plant's completion, but it is certain to be turning all wheels early next spring.

Wabash Plant

The Wabash Portland Cement Co., now owning and operating a plant at Stroh, Ind., has broken ground and is just getting a good start on its second plant which will be located about 1¼ mile north of the Southwestern plant. About 25 men, a steam shovel and well drill are on the job, excavating for sidings, foundations and roadway from the main highway to the plant site. The only buildings erected thus far, are camp, commissary and plant office.

W. J. Swegman, superintendent, stated that they expect to get started at concrete work shortly after the first of the year. The plant will have two 11-ft., 3-in. x 175-ft. kilns and waste-heat boilers; capacity, 2500 bbl. per day.

Mr. Swegman has just returned from Coreen, Ga., where he has been in charge of the erection of the Clinchfield Portland Cement Co.'s new 2000-bbl. wet-process plant. He reports that this plant is expected to be in operation shortly after March 1.

The Wabash company is hopeful of making a construction record on its new plant, so that it will be producing in time for the peak season during the latter part of August, 1925. L. L. Stone is the chief engineer, who is located at the company's headquarters, Ford building, Detroit.

Record Cement Consumption

A Significant Editorial in "The Iron Age"

FOR three successive months, June, July and August, shipments of portland cement have made new monthly records, a fact of no small interest. In 1923 only one new monthly record was made. These heavy shipments were not attributable to a run of light shipments earlier in the year, for the eight-month total was 5% above the corresponding total in 1923, which was a record year.

Some 15 to 20 years ago fears were felt in the steel industry that the rise of concrete construction would interfere with the growth of steel consumption; that concrete would in a measure "supplant" steel. It was not long, however, before it was seen that cement was really a coadjutor of steel, that it encouraged construction work and promoted a progress in which steel shared. As matters are now pretty well settled it is of interest to review the growth in the use of cement. As the growth of pig iron production is well known, and was considered marvelously rapid through the year 1916, a clearer idea is given by relating cement production to pig iron production.

The use of cement is recent only as the use of pig iron is recent. In the 10 years 1850 to 1859, 1.72 bbl. of cement were made per ton of pig iron. Twenty years later, from 1870 to 1879, only 1.01 bbl. were made per ton of pig iron. By 1900 the proportion was 1.25 bbl. per ton of pig iron, the proportion being less than that of a half century earlier.

In the 10 years after 1900 there occurred the rapid rise in cement relative to pig iron. Almost every year the proportion rose, even though the production of pig iron was increasing rapidly. In 1910 there were made 2.84 bbl. of cement to each ton of pig iron. The war stimulated pig iron much more than cement and that period may be skipped in our reckoning. In 1920 there were 2.71 bbl. of cement per ton of pig iron, or a little less than in 1910. Then came a good sized jump, to 3.38 bbl. of cement per ton of pig iron in 1923. A slightly higher proportion is altogether probable for the present year.

No direct comparison of values can be made, but it may be mentioned that the average value of cement as shipped in 1923 was $1.90 per barrel, equivalent to about $11.20 per gross ton, and that the 3.38 bbl. per ton of pig iron were thus worth $6.42. While the help that cement gives to steel is chiefly in facilitating construction and industrial progress, it is an interesting point that the production of concrete reinforcing bars in 1923 was 575,816 tons, or 2.2% of the total rolled iron and steel. The weight of the 137,460,238 bbl. of portland cement produced in 1923 was about 23,000,000 gross tons.

Shipments of portland cement in 1923, a new calendar year record, amounted to 135,912,118 bbl. The high month, a record at the time, was August, with 14,971,000 bbl. June of this year broke that record, July broke the June record and August has since broken the July record by showing shipments of 16,855,000 bbl. Shipments in eight months have been as follows:

1922	76,240,000
1923	91,245,000
1924	95,965,000

Presumably the increase over last year is due largely to road building, but wherever the cement has gone it furnishes testimony that much work is being done this year.

How One Cement Company Has Grown

WHEN the Atlas Co. took over this plant at Leeds, Ala., some five years ago, the productive capacity was between 500,000 and 900,000 bbl. per annum. Today its capacity is twice that figure. The history of the Leeds plant is the history of the company itself, which began in 1892, with a manufacturing capacity of 250 bbl. per day. Today its plant at Northampton, Penn., alone has a daily capacity of 25,000 bbl., or one hundred times the capacity started 32 years ago. This single plant now covers about 30 acres of ground, and a fence built closely around the entire property would enclose about 60 acres. When in full operation, Atlas Northampton mills consume about 9000 tons of raw rock and 2000 tons of coal per day, and employ 4500 men. These figures, which concern the Northampton plant alone, give an idea of the capacity of Atlas as a whole.

The company has other large plants at Hannibal, Mo., Hudson, N. Y., and Independence, Kans., which total a productive capacity amounting to approximately 18,000,000 bbl. a year.—*Birmingham (Ala.) Age-Herald.*

New Michigan Cement Plant Is Projected

MICHIGAN is to have another big cement plant. It will be known as the Boyne City Portland Cement Co., and its capital will be $2,000,000. The company's mill will be erected on Pine Lake, giving it deep-water transportation.—*Michigan Contractor and Builder.*

Temporary officers include: W. H. White, president; L. W. Siegel, secretary and treasurer, and these directors: Joseph Dunn and W. M. Martin of Boyne City, William J. Pearson, Boyne Falls, and John Yuill of Vanderbilt. Articles of incorporation have been filed and work of organization is moving smoothly.—*Grand Rapids (Mich.) Herald.*

Sand and Gravel Has Year of Great Progress

Increased Production with Much Technical Advance in Preparing Products for the Market — Unusual Plants and Dredges Built

THE inrease in sand and gravel production of 1924 over 1923 will probably not equal that of 1923 over that of 1922 which was 48%. However, producers have almost unanimously reported, in reply to ROCK PRODUCTS' questions, that there has been a substantial increase. Some producers have expressed their increases in percentages, as 10%, 18%, 25% and 50%, and one or two producers say that they have doubled their outputs. Only 7% of the producers reporting show a decrease in production. One stated that his production was less by 40% and another 30%. Those reporting decreases with one exception, wrote from parts of the country where business was notoriously bad the first part of the year on account of agricultural depression.

But the figures of car loadings do not indicate so great an increase as might be inferred from the above. Of course there is a large part of the country's production that is not shipped by rail, and a great deal of sand and gravel is delivered directly by truck to the job. But in previous years the estimates made from car loadings and the information received directly by the editors of this paper have checked very closely with the records of the Geological Survey.

From the reports received, it is the editor's opinion that the production of 1924 is about 154,000,000 tons, which is 10% more than the 1923 production.

Good Prospects for 1925

As to the prospects for 1925, the producers generally seem to be optimistic. Estimates of increase in the coming year run from 5% to 50%, and one or two producers say that they expect to double their production and point out that they are backing up their faith with works by doubling their plant capacities. A few say that they expect decreased outputs and give reasons which are based on local conditions. But on the whole the prospect for an increased output of the entire industry seems to be about as good as it was at the beginning of 1923.

Prices on the whole appear to have been slightly lower in 1924 than in 1923. One may point out that an increasing production and a lowering of prices indicates a healthy state of the industry. The lowering of prices has come from the lowering of production costs, due to larger and better managed plants. Temporary wayside pit competition has by no means disappeared, but it is going fast and the effect has been to lower the price of the screened and washed product, as the plants producing it have been able to decrease costs by increasing the plant output. A few producers report an increase in prices, one of 6%, another of 10% and a third of 15%, but the few increases are more than offset by the greater number of reports of lower prices.

The tendency for small companies to combine into large companies and for large plants to succeed small plants has been very marked in the past year. In fact the increase in the number of large producing units has been the outstanding feature of the industry in 1924. Plants with a daily output of 5,000 tons and upward were rather unusual a year ago, but in 1924 plants of 8,000 and 10,000 tons were built and 5,000-ton plants became quite fairly common. In some cases plants of less than 5000 tons capacity were brought into the 5,000-ton class by additions to the plant and equipment. Many smaller plants increased tonnages, as from 500 to 1,000 tons, 1,000 to 1,500 tons or from 2,000 tons to 2,500 tons.

It is for this reason that the big investments in the sand and gravel industry in 1924 have been made by the established producers either in building new plants or in adding to old plants. This is evidence of the way in which the industry is stabilizing itself and placing itself among the solid industries of the country.

Producers are almost unanimous in reporting that present conditions favor the large plant and it is important to know that these conditions are not the necessity of lowering labor costs and overhead. They are the constantly increasing and insistant demand for better material and the necessity of being able to make prompt deliveries of large quantities of material, the latter of which conditions the small plant, from the very fact that it is small, is not able to fulfill.

Smaller Plants Show Increased Production

At the same time it must not be thought that the small plant has been driven out of business to any extent in 1924. Such plants have shared in the general increase in business for they are usually located where only a small production is justified. This is the case where deliveries are wholly by truck and in localities where no large amount of highway work or other big jobs are carried on. And it has been proved that the largest companies often find it more economical to run a number of small plants rather than one large one. What is pointed out here is that the demand in 1924 favored the production of large tonnages and that big plants have been built and smaller plants enlarged in response to this demand.

Labor Conditions Good

There is a quite general belief that it is time to hedge a little on expansion of production and devote more time and money to perfecting operation to reduce costs—or as one larger producer, whom we know has given the matter much thought, puts it—more investment to improve the product rather than reduce costs.

Labor conditions in the industry have everywhere been good. No plant reported any serious labor shortage and all said that the tendency of wages was to remain at a fixed level. Some producers in addition to this pointed out that in their localities working in sand and gravel plants had come to be looked upon as a regular trade and that there were men who followed it in such numbers that the supply was not only sufficient but of good quality. No producer said that he looked for lower wages in 1925, but on the other hand no one seemed to think that wages were too high.

Car supply seems generally to have been adequate, only two producers complaining of car shortage. Railroad rates, however, are still vexing to some producers, not so much because they are high but because in the cases where complaint was made they seem to be unfair. The question of railroad rate revision and the adoption of a mileage basis for rates was variously received by the producers to whom it was put. In the main the producers favor rates on a mileage basis, provided, as one producer puts it, "that this is not used as a lever for a general raise in rates." The abolishment of Kelly's combination tariff was not favored by those who (from the way in which they wrote) appear to have given the subject much study.

Problems of the Industry

Questions were asked the leading producers as to what was the most important problem before the industry, and these brought forth an odd assortment of replies. "Better railroad rates" was given

as the answer a number of times. "Elimination of wildcat promotion" was what one producer wrote, and several others thought it was the "elimination of wayside pits." But a surprising number seemed to think that the main problems of the industry were technical rather than commercial and their answers might be summarized as, "how to make better material at a lower cost."

As to what was the most important advance in the industry in 1924 few producers wished to commit themselves, but those who did venture an opinion generally thought that it was the ability of the producers to meet increasingly rigid specifications. One producer said that it was the increased respect with which gravel was regarded as a coarse aggregate, while another said that in his locality at least the greatest advance has been the forming of a state association.

To sum up: The year 1924 has shown a substantial increase in production over 1923 and a further increase is predicted for 1925. Prices on the whole have been slightly reduced in 1924 and promise to remain at the same level in 1925. The tendency is to build fewer and larger plants, and this has been brought about by the demand for better material and for the ability to make prompt deliveries of large quantities. New investments have largely been made by those already in the business. Labor conditions are good, both as to labor supply and wages paid and promise to remain so. Railway rates and car supplies have generally been satisfactory. The main problem of the industry is how to produce better material at a lower cost and its chief advance has been in meeting more rigid specifications. These are not only the opinions of the producers; they are a summary of what Rock Products' editors have observed in their editorial travels.

Review of Technical Progress

PROGRESS in the methods of producing sand and gravel and preparing it for the market has been widespread and important in 1924. The building of larger plants and the demand for better material has called for different equipment from that formerly used both in size and design. Some difficult problems of washing, such as the removal of lignite and trash, appear in a fair way to be solved. New methods of handling material have been introduced. New types of marine equipment have cut the cost of water transportation. Storage plants have been built in increasing numbers. In dredges, designs, both of suction and clamshell dredges have appeared that are so new as fairly to be called revolutionary. Crushing gravel to sand may be said to have passed the experimental stage and the making of special sands has advanced and promises to be of great importance in the future.

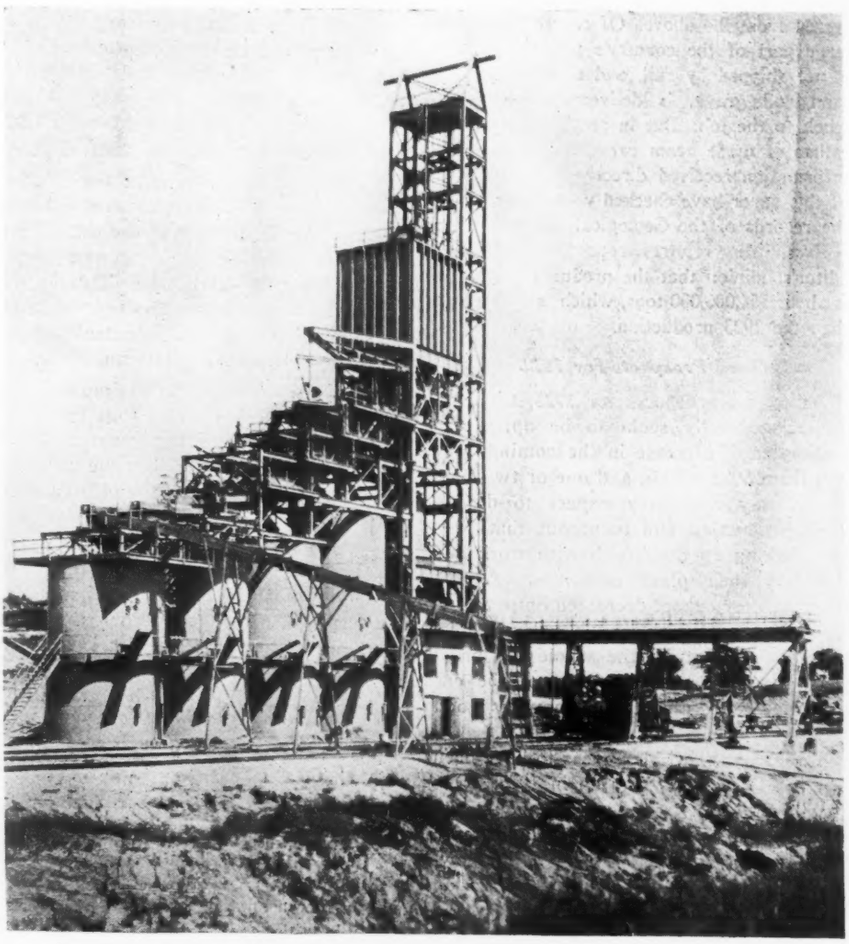
Excavating Methods and Machinery

In the larger excavating machines, steam shovels and dragline excavators, the advance has been that common to all industries in which these machines are used. However, there have been some exceptionally large machines of this sort installed for use in sand and gravel operations. Perhaps the largest in point of bucket capacity is that of the Roquemore Gravel Co., Montgomery, Ala. By shortening the boom from 90 ft. to 75 ft., this company was able to equip its machine with a 6-yd. bucket and fill one 6-yd. car at each swing. But such a machine is really no larger than the dragline installed by the Wisconsin Lime and Cement Co. at its Crystal Lake, Ill., plant, which handles a 3½-yd. bucket at the end of a 120-ft. boom.

Electric shovels have been installed by a number of plants and all that have come to the writer's attention are on caterpillar treads. Steam shovels of larger capacities than formerly seem to be the rule. A typical example is found in the operation of the O'Brien Brothers Corporation on Long Island in which two shovels with 4½-yd. dippers are employed.

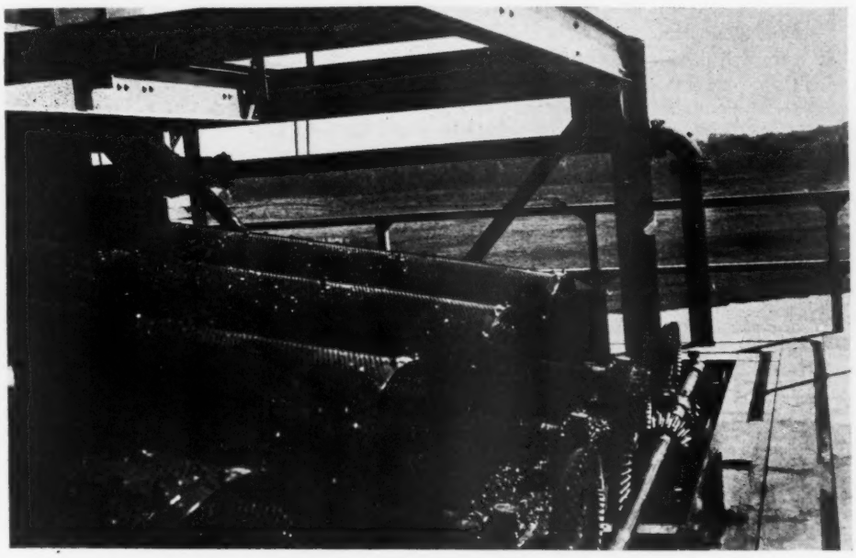
In the cableway dragline, which is employed more than any other digging device in plants of less than 2000 tons daily capacity, there have been some small but noteworthy improvements, both in the "slackline" and the scraper bucket form. One of these applied to the Sauerman "slackline" excavator is a ball-bearing block used on the lower tension cable. This was originally introduced to obviate the nuisance of climbing up to the block to lubricate it, but it has really added to the speed of the operation by making a faster return of the bucket possible.

The two-speed hoist for the cableway dragline was really developed in 1923, but its use did not become at all common until 1924. This has also increased the speed of operation. By the use of this hoist and some other minor improvements



Crystal Lake plant of the Wisconsin Lime and Cement Co. Balanced self-dumping skips, running in vertical guides, hoist the material to the feed bin

one company is now able to dig 1500 yd. per day with a 2½-yd. bucket, working over a radius of 900 ft. This plant was put in by a contracting firm to furnish sand and gravel for a job in an isolated situation and it represents a considerable advance over what was formerly considered possible with this type of excavator.



Part of the screen battery at the Crystal Lake plant

The principal improvement made to the scraper bucket is a device recently patented by Sauerman Bros., which enables the bucket to dig along the edge of its path, taking its load from the side. This has considerably increased the working facilities of this machine.

Transporting and Conveying

The newest device for transporting the bank material from the pit to the plant is the storage battery locomotive which was introduced in the plant of the Montgomery Gravel Co., Montgomery, Ala. (described May 31). From all reports this machine is proving a success, especially in cutting down the time lost in coaling up, waiting for water and making minor repairs. Even though the actual running expense should prove to be more than that of the familiar dinky by the time that the storage battery has been replaced, the owners believe that the machine will show a saving on account of lessened lost time.

Among the new ideas in conveying, one of the most striking is the use of the balanced, self-dumping skip in place of the familiar belt conveyor for feeding a plant. There is nothing new in feeding a plant with skips, of course, but their use is not usual in the sand and gravel industry, and nowhere does one see skips that are better designed and installed than in two of the plants designed by the J. C. Buckbee Co. One of these is the Crystal Lake plant, referred to above, and the other the plant of the Union Rock Co. near Los Angeles, described in Rock Products, July 26. The skips at the Crystal Lake plant, which will be more fully described in a later issue, each hold 8 yd. and are unusual in that they work in vertical guides as in a mine shaft. At the Union Rock Co.'s plant the skips run on an inclined track, about 70 deg. from the horizontal.

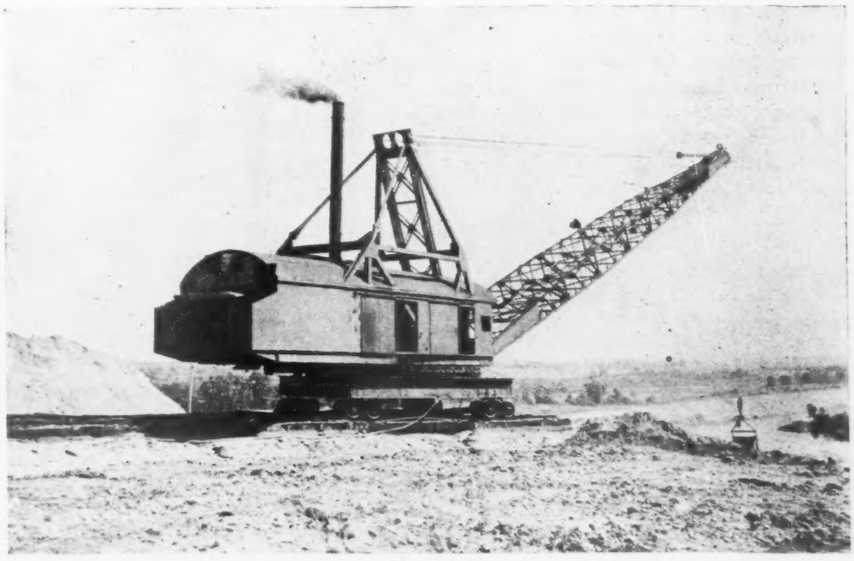
Both these plants are splendid examples of design and construction, being wholly constructed of steel and concrete.

It is hardly to be supposed that skips are to supersede conveyor belts for feeding a plant, but they are the right device to use whenever the material to be handled contains very large pieces (boulders) where it is very wet or where it contains many sharp and angular pieces that would be liable to damage the belt. In other cases the conveyor belt has too many advantages to be displaced by them.

And, speaking of belts, perhaps the installation with the largest capacity is that at the Roquemore plant referred to above. This belt is 48 in. wide and has 218 ft. centers. It operates at a somewhat flatter angle than the usual 3 to 1 inclination, which the writer believes to be a good feature and it easily handles 800 tons per hour. This Roquemore plant, with a daily capacity of 8000 tons per day, is one of the most notable plants of the year. It was designed by Frank Welch of the Greenville Gravel Co. and was described in the June 28 issue.

There have been a number of notable belt installations in the past year. Among these one may note that of the Ferrysburg plant of the Construction Materials Co. of Chicago at Ferrysburg, Mich. The raw storage from the dredge is unloaded over a concrete tunnel 200 ft. long in which runs a 36-in. belt. Gates allow the material to feed on this belt which transports it to another belt that lifts it to the head of the plant. Of belts which load from storage piles perhaps the most noteworthy is that of the O'Brien plant referred to above.

A belt installation that is especially worth mentioning is that of J. L. Shiely of St. Paul, described November 1, because it solved a common problem; that is, what shall be done with the plant when the deposit for which it is built gives out. The answer in this case was to connect the plant with another deposit 400 ft. away and on the other side of 16 railroad tracks. The connection was by means of a conveyor belt carried on a substantial bridge over the tracks.



Dragline with 120-ft. boom at Crystal Lake plant

Screening and Sand Separation

The Roquemore plant has the sand and gravel screens that Mr. Welch has de-

veloped. They are of the full trunnion type, permitting a large water pipe to be run through them which allows about two-thirds of the water used to be applied in the washing sprays in the screen. A good idea in connection with the sand screens is the placing of a heavy screen with a 2-in. perforations inside the fine screen. This protects the fine screen and also spreads the feed so as to bring more of the sand screen in action.

Another good idea in screening is found at the Montgomery plant referred to above, which was introduced by C. S. Huntington of the Link-Belt Co., the designer of the plant. The last of the series of conical gravel screens which separates the gravel between ¾-in. and ¼-in. is rescreened over a ¼-in. screen provided with a clear water spray for rinsing. This insures an exceptionally clean product of this difficult size. The Shiely plant shown below was designed by the same company.

Vibrating and shaking screens do not seem to be particularly increasing in use, conservative plant designers adhering to the familiar rotating type. However, there are a number of new vibrating screens that promise to be of great value to the sand and gravel industry.

In sand separating, nothing new has been brought to the writer's notice. It seems to be the tendency of plant operators to build their own separating devices and to prefer the simple tank with valves operated by hand.

Crushing Sand to Gravel

The crushing of sand to gravel, which in some sections is one of the pressing problems of the industry on account of a greater demand for sand than for gravel, made some progress in 1925. The largest plant yet built for this work was erected by the Keystone Sand and Supply Co., Pittsburgh, in 1924. This uses rolls in series, crushing wet. The use of a hammer mill crusher, which had done excellent work on limestone, was tries as a gravel crusher in a Tennessee plant but proved a failure.

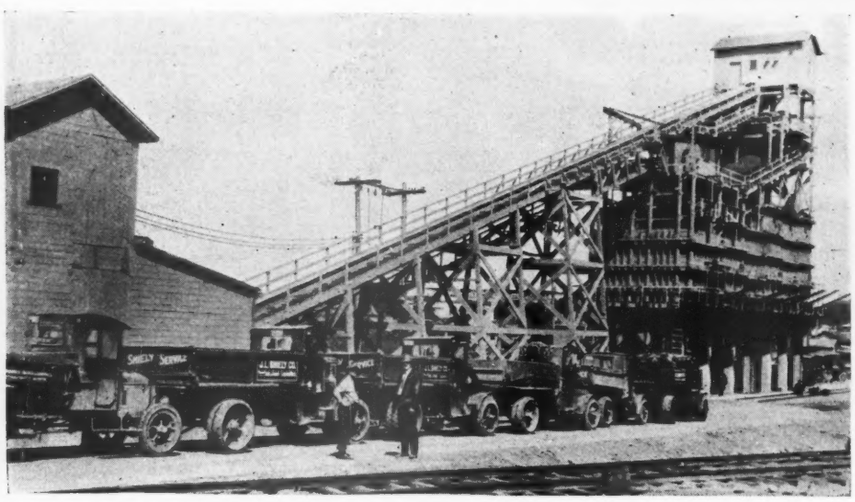
Special sands are attracting a great deal of attention from producers and some plants for producing them will be built in 1925.

Unusual Plant Designs of 1924

THE past year has seen a number of excellent sand and gravel plants erected, but space will permit a review only of those which for one reason or another may be considered unusual. By this is meant plants in which there is some new method used or equipment which is new to the industry, or those plants in which there is noteworthy improvement in the design or construction.

Of all the plants of the year the writer considers the new plant of the Central Sand and Gravel Co. at Memphis, Tenn., to be the most important from the standpoint of technical progress. This is for a number of reasons, the first of which is that it washes a gravel that had been considered "impossible" because of its lignite content, and because a number of previous attempts to wash out this lignite to make a good commercial product had been failures. Next it is a very good plant as regards design and choice of equipment. And finally it is very well constructed. L. T. McCourt, the secretary of the company, is mainly responsible for the design of the plant.

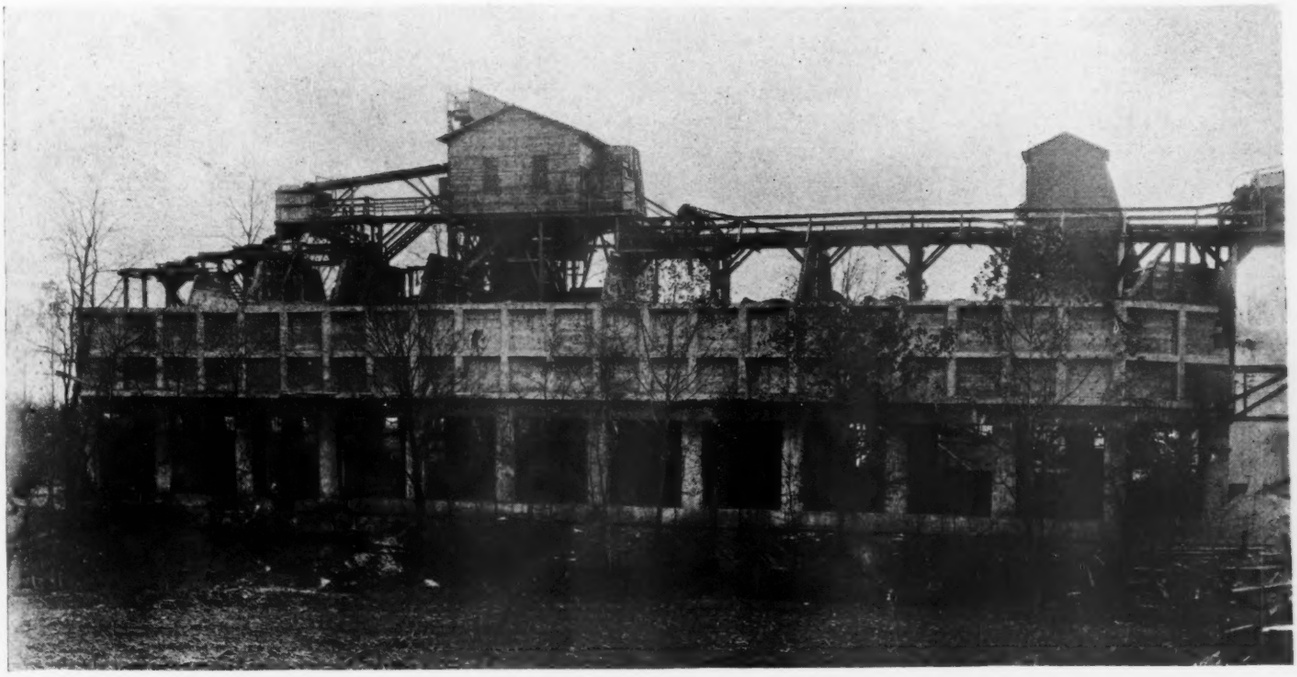
At the Ferrysburg plant of the Construction Materials Co. of Chicago a long belt in a concrete tunnel feeds the plant from a stockpile



Plant of J. L. Shiely, St. Paul, one of the best designed and equipped plants of 1924

A progress story was given on this plant in the issue of June 14. Since that date it has been completed and sufficiently tried out to insure the full success of its method.

At the present writing the plant is washing material taken from the bed of the Mississippi about a mile above Memphis, although a gravel with less lignite can be



Central Sand and Gravel Co.'s plant, which washes lignite from gravel, a process before thought of as impossible in a commercial way

secured about 40 miles above the city. It is pumped by a combination dredge and towboat, the *D. M. Armstrong*, which is equipped with a 16-in. Ellis pump. About 35% of the deposit is sand. Sand and gravel together are pumped into 1,250-ton steel barges of the flush deck type. There are two of these, each 175 ft. long, 36 ft. wide and 9 ft. deep. The cargo box on the deck is 4 ft. deep. The loaded barges are towed to the plant landing where they are unloaded by a 2½-yd. clamshell, on a stiffleg derrick, to a hopper which is above a 36-in. conveyor belt with 385-ft. centers. This belt takes the material to a scalping screen with 1¾-in. holes at the head of the washing plant. The oversize falls to a Kennedy crusher and is returned by an elevator to the same screen. The undersize goes to a belt with a tripper which distributes it to several bins.

This unusual procedure of putting the material in bins before it is washed and screened is essential to the washing method employed, which demands an even and regular feed. Another reason for putting the material directly into bins is that a considerable amount is sold "as is" for railroad ballast, and this is loaded from the receiving bins directly into cars.

The sand and gravel that are to be washed pass by chutes from these bins to a flat belt. One or more bins may feed to the belt at the same time. From the belt the sand and gravel go to the jigs which are among the novel features of this plant. The jig was described in Rock Products for June 14. Briefly it is the same machine used in coal washing to separate slate and other rock from coal. But at this plant the process is reversed, the coal (lignite) being the waste product which it is desired to separate, so the design of the machine had to be changed in many details. It is practically a new type of jig.

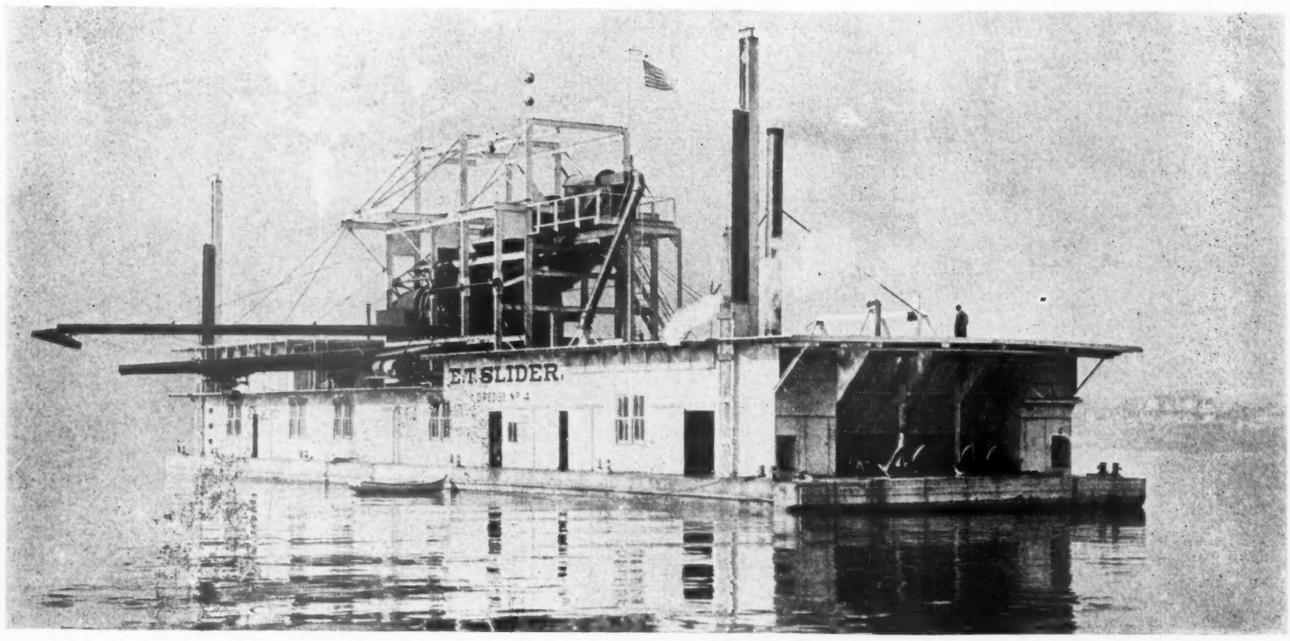
The jigs have a ½-in. bar screen in the bottom of the sand and gravel compartment and everything finer than ½-in. is pulled through this screen by the suction of the piston in the water compartment. A very complete separation of sizes is made by the jig in this way as well as a separation of the lignite from the gravel.

Everything over ½-in. goes from the jig by an elevator (the jigs are on the ground level) to a 1¼-in. screen. The oversize of this screen (between 1¾-in. and 1¼-in.) goes to one bin and the undersize (between 1¼-in. and ½-in.) to another, known as the coarse and fine "binder" bins.

The jig undersize (all below ½-in.) is elevated to a gravity bar screen with 3-16 in. spaces. The oversize goes to the "torpedo gravel" bin. The undersize, with the accompanying water, flows to two settling tanks in series. The first makes concrete sand and the second a fine sand for brick laying, tile setting and some sorts of plastering.

Plant of the Terre Haute Gravel Co. Unusual because of the extent to which scrubbing is carried

Besides the use of jigs, this plant has



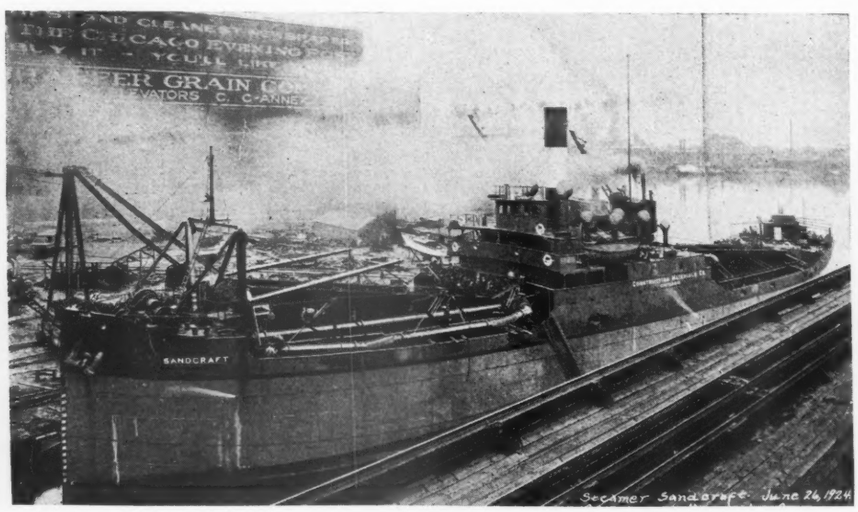
The "E. T. Slider," one of the largest and best equipped suction dredges ever built

another unusual feature in that it makes the first screening on an intermediate size, ½-in., both the oversize and undersize of this screen being further screened and classified. This method saves headroom, and while it has been applied in other industries it is the first use the writer has seen in a sand and gravel plant.

The bins in this plant are unusually large as they hold 35 carloads. This is partly due to the washing process employed. But the use of large bins is in contradiction to what has been noted in the large plants of other fields, practice tending more to ground storage with only bin capacity to permit changing cars.

A plant which is noteworthy for having carried scrubbing and washing away beyond the usual limits is that of the Terre Haute Gravel Co., at Terre Haute, Ind. Such a plant might even serve for washing phosphate rock or some of the other substances in which clay balls and hard films of clay are encountered and which have to be very carefully washed to secure a commercial product. The engineer of the plant was John A. Cushman of Terre Haute, but the design of the plant is largely due to George Nattkemper, vice-president of the company, and Rudolph Nattkemper, plant superintendent. It is the fifth plant built by this company.

The bank material comes from two pits, one of which is high in gravel, the other high in sand. By drawing from both pits a mixture that will satisfy the market's demands for both sand and gravel may be made. A dragline with a 2½-yd. bucket is used at one pit and a 25-ton locomotive crane at the other. Standard gage 25-ton cars convey the material to the plant.



The "Sandcraft," a sea-going hopper dredge, probably the largest in the industry

The material goes by a 30-in. conveyor to a 48-in. scalping screen with 2-in. perforations. The oversize is crushed and the crusher product returned to the screen. The undersize of the screen goes by a belt to the scrubbers.

These scrubbers are the unusual feature of the plant. They are 12 ft. long and 6 ft. in diameter and have mixing blades, the same as those used in a concrete mixer. Water is fed in at the same end as that from which the stone discharges so that the water flows against the travel of the stone. Hence all the dirt and clay is washed out as fast as it is freed from the sand and pebbles by the action of the scrubber.

Further washing is given in the screens which are 20 ft. long and 4 ft. in diameter with ⅛-in., ⅜-in., ⅝-in., 1-in. and 1½-in. perforations. All the products except the sand are spouted to concrete bins. The sand goes to two sand dewaterers, the first equipped with a chain drag for drawing out the settled sand and the second equipped with an automatic discharge device. The second sand settler acts as a rinser for it is fed with clean water and the discharge of the chain drag.

Water comes from the Wabash river 4,000 ft. away. It is pumped by an 8-in. pump into a 15-in. sewer pipe and then runs by gravity to a sump near the plant from which it is raised to the top of the plant by another 8-in. pump.

A 5-in. centrifugal booster pump is used to give a heavy pressure to the spray water used in the screens. Before this pump was put in the sprays had 10 to 15 lbs. pressure but now they have from 75 to 125 lbs. This has resulted in cleaner gravel, the force now being sufficient to remove the hard films of clay on the surface of the pebbles and even

to disintegrate any clayballs that have not succumbed to the action of the scrubber.

Another fine feature of this plant which might well be copied in other plants is the use of sprays on the return side of the conveyor belt for keeping the belt clean. Brushes and other devices were tried at first but nothing was found to work so well as a simple spray.

The demand for cleaner material has everywhere throughout the industry called for improvements in methods and equipment. An example from the Pacific coast is found in the plant of Clarence F. Pratt, better known as "Sandy" Pratt from his clever advertising. He has put log washers in his plant on the American river near Sacramento, Calif., and is creating a strong demand for his "triple-washed" sand which is as free from clay and dirt as sand can be if the samples sent out are any criterion.

The new Number Nine plant of the Stewart Sand Co., near Kansas City, Mo., has a somewhat unusual sand classifying system. The sand is pumped from the Kaw river to a relay pump and dewatering cone on the bank and from this it is pumped to a large cone that acts as a steadying tank and partial dewaterer. From this cone it goes to two automatic sand settlers and the overflow from these to three automatic sand settlers. Both Allen tanks and Dull cones are used. Hydraulic water is introduced in all of these sand settlers. By regulating the water fed with the sand and by varying the hydraulic water admitted the classification is controlled to make different products as these are wanted.

The Capital City Sand Co.'s plant, Des Moines, Iowa, described in the May 17 issue, presents an interesting design of a plant to be used with a cableway dragline. Both dragline tower and screening plant are of steel construction. The design is of the "skeleton" variety, that is there are no storage bins, ground storage and loading bins situated some distance from the plant being used to hold the product.

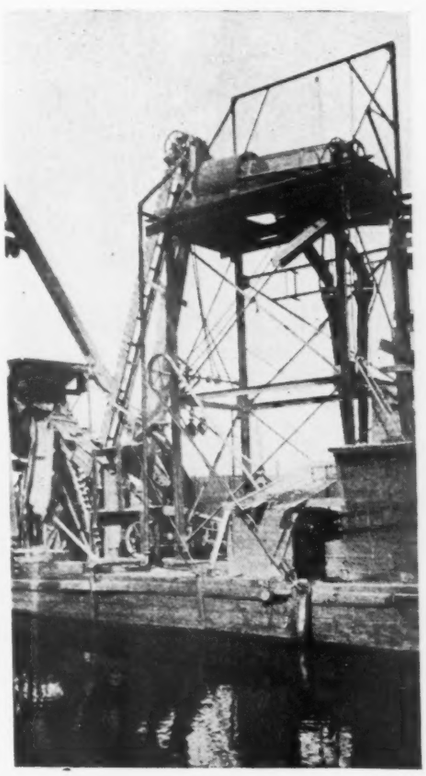
The screening system of this plant is unique in some respects. The main 4½-ft. rotary screen is really a scalper which gets rid of oversize, which is sent to a crusher, and sand, which is sent to settling tanks. The gravel between 2¼-in. and ¼-in. goes to an inclined screw conveyor which acts as a washer, all the sticks and trash going out of the low end while the gravel is discharged dewatered at the high end as in a logwasher. The gravel is then screened into sizes by an electrically vibrated screen.

Dredge Building in 1924

IN no branch of the sand and gravel industry has more progress been shown in 1924 than in that of dredges and marine equipment. Rock Products has noted some of this. As an example may be mentioned the dredge of the Tennessee-Arkansas Gravel Co., at Arkansas City, Ark., which dredges from the Mississippi river. It is powered with marine type oil engines and was described in the August 23 issue. There is also the description of the new design of flush deck barge adopted by T. L. Herbert & Sons of Nashville, Tenn. and the new Diesel powered towboat *Harvey* of the same company. The adoption of the barge design shown has cut the time required for a tow about 16 per cent and the further adoption of Diesel power has brought towing costs to only a fraction of what they formerly were. The barge and towboat (the first stern wheel boat to be equipped with full-Diesel engines) were described in the issue of September 6.

The change from steam to oil for towing seems to be practically complete. The writer was along the Ohio river in the early part of the year and saw a number of towboats either building or just built, and oil engines were used in all of these. In general the semi-Deisel type seems to be preferred but there is some reason to believe that the full-Diesel type may be used more in the near future. The manufacturers of full-Diesel engines have perfected the control and operation of the smaller models until now they are as "handy" as a steam engine.

Pre-eminent among the oil powered dredges of the year is the dredge *E. T. Slider*, owned by E. T. Slider of New Albany, Ind. This is the largest suction dredge on the Ohio river and among the largest suction dredges in the United States.



Dredge with swinging A-frame (at left)

The hull is 176 ft. long and 50 ft. wide. It is 6 ft. deep, but draws only 3 ft. of water. In appearance it somewhat resembles the big ladder dredges operated on the upper Ohio, for it carries a full washing and screening plant. It has like these a central well 80 ft. long and 8 ft. wide in which the 75 ft. suction ladder is suspended. This carries the pump suction and the boulder box. This ladder is swung so that the dredge can work to 50 ft. of depth.

The dredging equipment consists of a 15-in. manganese steel pump of the type designed by the American Manganese Steel Co. for heavy sand and gravel duty. This is driven by a 300 hp. Fairbanks-Morse oil engine of the medium compression type through a 42-in. belt. There is also a 10-in. American Well centrifugal pump which supplies water for the washing and screening plant.

Further power requirements are furnished by two small marine boilers working at 190 lb. pressure, which supply steam to 12 sets of double-cylinder, single drum reversible engines, which are used to handle the anchors, spuds and suction and to move barges.

The washing and screening plant has four Link-Belt screens, making all the commercial sizes of sand and gravel used locally. The gravel from the screens is carried out to the barges by a 30-in. conveyor that projects from the side of the dredge. The sand goes to two round chutes on the opposite side by which two sizes of sand are delivered to the sand barges.

The living quarters for the crew are exceptionally well equipped. There is a large roomy cabin and kitchen, pantry and linen closet. There are nine state rooms and the beds are furnished with good springs and mattresses and there are washstands and shower baths in abundance. The whole dredge is lighted from its own electric light plant and a still furnishes pure drinking water.

The fuel tanks hold 17,238 gallons of oil or something over a car load.

The "Sandcraft"

What is probably the largest sand suction dredge employed anywhere in the United States is the sea-going hopper type dredge *Sandcraft*, which was put into service last August by the Construction Materials Co. of Chicago. This boat dredges sand on the Michigan shore of Lake Michigan, using two 20-in. centrifugal pumps of a special design. The boat's hoppers will hold 2000 yd. and they are arranged so that the cargo can be pumped out as easily as it was pumped in. A detailed description of this dredge and its

many noteworthy features is scheduled to appear in an early issue.

No especially large ladder dredges were built during the year, but the Dravo company of Pittsburgh built two just alike of the usual size, one for its own use (as the Keystone Sand and Supply Co.), the other for the Ohio River Sand and Gravel Co. of Louisville, Ky. A brief description of these dredges was given in an editorial letter published November 15 and a fuller description is to appear shortly.

The clamshell dredge, with stiffleg derrick seems rather to be growing in favor. The reason for this in some cases is to be found in the exhaustion of river deposits so that the dredge must work over old ground and prospect for material as it goes. In other cases where the deposits are shallow and "patchy" this type of dredge finds favor. An excellent example of the use of these dredges will be found in the article on the Whitney Bros. operations near Duluth, published October 4. A description of their new dredge *Clyde* was published April 5.

T. L. Herbert and Sons, Nashville, have been at work upon a dredge of this type which presents some unusual features and shows considerable more study in its design than most of these dredges do. It will be fitted with opposing cranes and clamshell buckets to balance digging strains and it will also be equipped with a washing and screening plant.

A small dredge of this type that has its interesting points was built by Robinson and Eldred of Auburn, N. Y., and is operated on the shore of Lake Ontario near Oswego, N. Y. The peculiar thing about this dredge is its method of handling the clamshell bucket. The line which raises and lowers this passes over the top of an A-frame on the bow of the dredge. This A-frame is pivoted at the bottom and controlled by a line from the hoist. When the clamshell is to be lowered the A-frame is allowed to fall forward so that the clamshell is over the water. When the loaded clamshell is hoisted above the deck of the dredge the A-frame is swung back until the clamshell is over a hopper into which it discharges. The advantage of this system is that it lessens the strain on the hull. It also allows a better disposition of the machinery on the dredge. A screening and washing plant is also a part of this dredge's equipment and the washed and screened products are chuted to barges at both sides of the dredge. J. W. Robinson, one of the owners, invented this method of handling the bucket, the details being worked out by Jean Allen of Chicago.

Barges have not changed much during the year. There is room for other companies to do what the Herberts have done; that is, to design a barge adapted to local conditions which will reduce towing costs. Flush deck barges are coming more and more into use and cargo boxes tend to become deeper.

Review of Glass Sand Industry

THE silica sand industry has shown a considerable gain in 1924 both in increased output and new plants built. In addition to the new plants some of the older plants in the eastern states have been rebuilt and one or two old ones which had ceased production have been put into service again. The industry at the start of 1925 appears to have excellent prospects for the coming year. This is mainly due to increased use of silica in glass and other regular lines for so far as could be learned no new use of silica has developed of sufficient importance to add materially to the market's demand.

Probably the Pennsylvania field will be found to have shown the greatest activity in 1924. The writer was at Mapleton, Pa., which is one of the important centers of the industry, and found that the Pennsylvania Glass Sand Co. was building a large plant which is expected to be ready to operate in a month or two, that the Pittsburgh White Sand Co. had rebuilt one of its plants and was rebuilding another and that this same company had taken over the Juanita White Sand Co. and was preparing to rebuild the old plant and renew its operation. Near Lewistown, Penn., the Mifflin Sand Co. had finished its plant and was already building a second unit. There is also the new Ford plant at Glassmere, Penn., described in the September 20 issue.

In the Hancock-Berkley Springs district which lies on both sides of the Potomac in Maryland and West Virginia there were no new plants being built but several were making improvements. The Berkley Glass Sand Co., for example, was installing a new boiler in a separate brick building to furnish steam for drying. A series of articles on the plants of this district is scheduled to appear in an early issue.

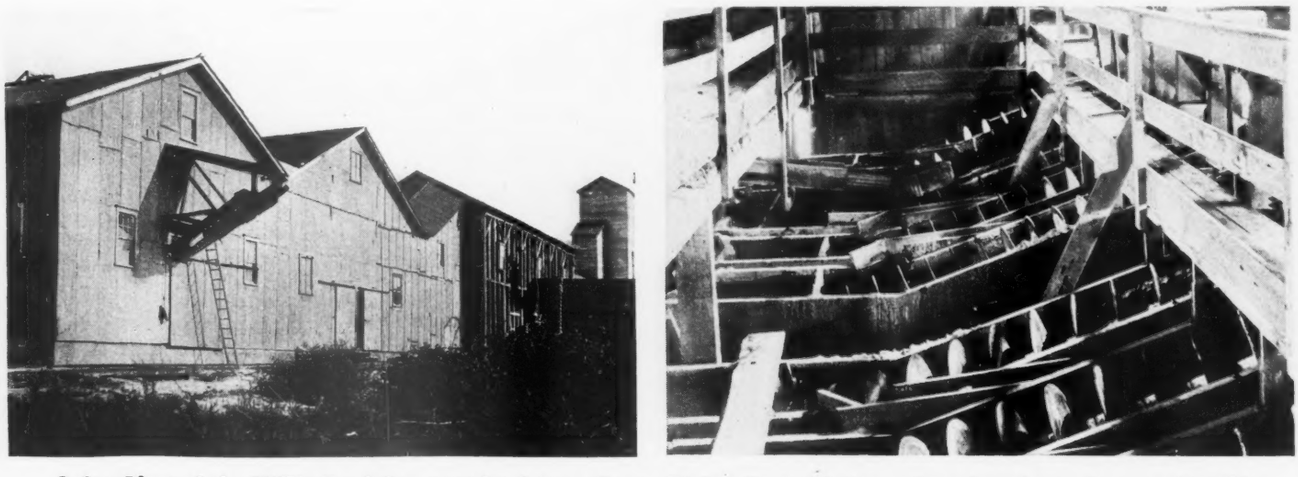
In New Jersey considerable activity has been reported and a new plant is being built at Millville by the Tavern Rock Sand Co. of Bridgeton.

Reports from the Ottawa district have been conflicting, one important producer estimating that the output of the district had not increased as a whole while another places the increase for the district at 15 per cent. One new plant of 1,000 tons daily capacity has been built by the Crescent Silica Co. of Chicago.

In the Southwestern field it appears that production has been more or less stationary with no new plants reported. However an increased production is looked for in 1925.

Production in Ohio is principally of sand for refractories and in this there was no increase in production. The new plant of the Everhard Co. was completed and put into production in the early part of the year. This is the plant on which a progress story was run in the 1923 Annual Review number.

On the West Coast there has been some



Left—Plant of the Mifflin Sand Co., near Lewistown, Penn. Right—Part of battery of sand washers. A new unit to this plant contains 30-in. sand washers, the largest yet built

production although the imports of Belgian silica sand through Pacific coast ports still supplies the major part of the sand used there. It is reported that silica sand may be imported from China, which is developing the industry to some extent.

Prices have been very stable as shown by ROCK PRODUCTS markets. The going price in the principal fields has shown little or no change throughout the year. This may be taken to represent a healthful condition of the industry, an increasing output and a stable price indicating that profits are more dependent on decreasing costs by increasing output than by raising prices.

Freight rates have been fairly satisfactory for some sections and in others quite the reverse. Some of the producers who have reported to ROCK PRODUCTS said that they considered the securing of fair freight rates to be the principal problem with which the industry was confronted. In other sections, notably the Illinois field, a reduction of rates proved of great value to the industry.

Technical Progress

Technical progress in the preparation of silica sand for the market has not been especially marked during 1924. The large producers in the eastern states have standardized methods and in general employ about the same equipment. This has been found so satisfactory that there is little disposition to change it.

These plants first crush the sandstone in jaw crushers, then grind it in "chaser" mills of the Chilean type and screen through a revolving screen especially developed for this work. Afterward the sand is washed and re-washed in sand washers of the screw type and then sent to the dry house. From the dryers which are now all of the indirect heat type, the sand trickling down over steam pipes, the sand goes to screens for final sizing and then it is sent to the loading bins.

Plant of Pittsburgh White Sand Co. rebuilt in 1924

In this system of milling an important advance has been made by the introduction of larger sand washers. The Mifflin Sand Co. in its new unit has put in sand washers 30 in. in diameter. These have a much greater capacity than the smaller sizes, as the capacity increases in a much greater proportion than the increase in the diameter.

These washers and all the other machines in the plant were designed and built by the Lewistown Foundry and Machine Co.

In the dry house various methods have been used to get the sand from the draining piles to the hopper of the dryer, but the favored method now seems to be the use of a traveling crane and clamshell buckets. Two of the companies in the Hancock-Berkley Springs district, the Berkley Sand Co. and the Hazel-Atlas Glass Co., have installed these cranes in the past year.

Improvements have been made in the steam dryer, the principal one being the complete regulation of each coil of steam pipes so that the heat may be applied where it is most needed. The last of the direct heat rotary dryers in use in the Hancock-Berkley Springs district went out of use a little more than a year ago. Tower dryers have been introduced in the Ohio field as reported in the preceding Annual Review number.

Berkley Glass Sand Co.'s plants improved in 1924

For screening the dried sand electrically vibrated screens are rapidly coming into use and displacing rotary screens as they are in other branches of the rock products industries, where a fine mesh screen is used. Excellent installations of these screens were noted at the plants of the Berkley Glass Sand Co. and the Pittsburgh White Sand Co.

For storage bins concrete silos are coming into use, the same as in the portland cement industry. Their use will probably increase. Excellent examples are found in the plant of the Pittsburgh White Sand Co.

The most unusual plant of the year is that of the Ford Motor Co. near Glassmere, Penn. This was described in the September 20 issue but some points of difference from the usual Pennsylvania plant may be pointed out here. In the first place gyratory crushers are used instead of jaw crushers. Then a "wet pan" is used instead of the "chaser" mill although the two are practically the same in principle. Instead of the usual screw washers Dorr classifiers are used.

Methods in removing deleterious material from glass sand have made some progress. Experiments are being made in one plant with magnetic separation and the writer was shown some samples in which the iron content has been reduced from .07% to .02% in this way.

The working up of waste sand to commercial products has met with some success. One plant disposes of all the fine sand it can collect for use on golf courses. Its whiteness and fineness makes it especially valuable for this purpose.

Review of the Lime Industry in 1924

ACTIVITY in building construction in 1924 compensated for a loss of chemical lime business with many producers. For the industry as a whole it is doubtful if the increase in production during 1924 over 1923 exceeded 10%. Eighty per cent of our returned questionnaires showed estimated increases in production of 12 to 15%; in the Ohio hydrate district production increased by about 20%. On the West Coast the lime business generally was hardly up to the 1923 level. With a tendency toward overproduction in many localities the margin of profit was probably somewhat less in 1924 than 1923, although some of the largest producers reported approximately the same margins.

Opinion is about evenly divided as to whether 1925 will show approximately the same volume of business, or something more. Two who reported increases this year look for less business next year, but practically all who reported less production this year than last, expect a larger production next year.

Fear Overproduction

Labor conditions, wages and prices are reported stable and likely to remain so through another year. However, there are evidences of overproduction in certain sections of the East, South and in the Ohio hydrate section, and prominent producers in these localities express the opinion that 1925 is likely to see keener competitive conditions and somewhat lower prices. In the South at least one producer looks for a labor shortage because of the emigration of negro labor to the north. The only reason that there was no shortage this year, he thinks, was because of the temporary stagnation of agriculture.

There have been but few notable new plants completed in 1924. Among these were the rotary kiln plants of the Marble Cliff Quarries Co., (Rock Products, March 22, 1924) and the Tobey Lime Co. (Rock Products, July 12, 1924). Another new plant of the Champion Valley Lime Co. at Winooski, Vt.—we have referred to in the issues of October 4 and November 15, and some of its special features are illustrated herewith. It is not yet completed. Work on the new lime plant of the New England Portland Cement and Lime Co., at Rockland, Me., has been begun, we understand. Most of the other activity in new plants has been in the Ohio hydrate district and in the lower Mississippi Valley section. The plant of the Phoenix Portland Cement Co. to be built at New Orleans, La., during the coming year, will include a rotary-kiln lime plant.

Is the Lime Industry Holding Its Own?

While some new capital has come into the industry during 1924, a far larger investment, in the opinion of practically all producers, has been made for plant additions and improvements by established producers. Several producers express themselves quite emphatically that some of these new projects are promotional enterprises pure and simple, and that the new production they will bring is entirely unjustified by the present outlook. Producers are quite unanimous in expressing caution as to future expansion and unanimously emphatic in the opinion that present production methods must be improved and production costs lowered if the industry is to progress. It is apparently becoming evident to lime manufacturers, as it must be to all others acquainted with the industry, that lime manufacture has not progressed as fast nor as far in labor-saving and cost-saving methods as some of its competitive industries.

What the Ohio Hydrate Manufacturers Have Accomplished

There seems to be some doubt in the minds of many operators as to whether or not lime is holding its own in the rapid development of the building industry and in the rapid development in building material products. But while this may be the case in some localities there can be no doubt that the Ohio finishing hydrates have not only held their own but have shown as marked an increase in production and consumption as any other building product.

The total number of new kilns built by old established lime manufacturers in the Ohio dolomite field in the last two years is estimated at 52. New plants—two with 24 kilns—make a total of 76 new kilns. This new production compelled the older companies to increase their sales activities and to keep up or increase prices accordingly. The result has been such national advertising and sales promotional work as the lime industry has never before witnessed. *But the 20% increase in production was disposed of,* and at a profit!

Opinion seems to be about evenly divided among producers as to the practicability of ever making ordinary limes sufficiently plastic to compete with dolomitic finishing limes. There is, however, surprisingly more faith in the ultimate success of such an investigation than we had expected to find. However, there may be more truth than poetry in the rather caustic comment of one manufacturer: "Certainly the plasticity of some limes may be increased by the addition of other materials, but the resulting mixture is not lime."

Our own belief is that ultimately a way will be found to make limes plastic without the addition of other ingredients, but first of all we must find out what makes lime plastic and why 98 varieties of limestone give limes of 98 varieties of plasticity and other physical characteristics. As told on another page of this issue the United States Bureau of Standards is making real progress in this direction, but the solution is a long way in the future.

Lime Industry as a Field for Technical Men

Does the lime industry offer a promising field for technical men, such for instance, as research men at the individual plants? We are happy to say that at least some of the more progressive men in the industry believe it does. If there is any doubt in the minds of the others let them refer to the progress made in the last year or two through the efforts of just such specialists in the gypsum industry.

A few lime manufacturers can vision the time when they will not be making lime exclusively but *lime products.* A lime plant does not have to be a large producer to employ a technical man with profit—the right kind of a man for such a plant could look after many production problems and help materially to cheapen production costs. As one manufacturer quite aptly states: "There is still a lot to learn about lime and its manufacture."

Unintentionally one of our questionnaires fell into the hands of a lime consumer instead of a producer, and his comment on this subject is enlightening: "We purchase 800 tons of lime per month, using it to make calcium carbide. In the last four years we have been unable to obtain accurate analyses from producers within a 200-mile radius (and there are a considerable number in this locality—editor). The National Lime Association had no information in regard to these particular limes. Chemists capable of making accurate analyses and combustion engineers who can properly operate kilns and keep lime manufacturers from spoiling good limestone in the lime making by using sulphurous, cheap coal ought to be a real necessity at any plant specializing in chemical lime. The most important problem is to make the lime industry attractive to such men. When producers come to know their product thoroughly, they will each find the proper outlet for their particular limes."

Little Interest in Hydraulic Limes

Mighty few lime manufacturers express any interest in hydraulic limes. Yet of all the rock products during the past few years none have shown more remarkable growth in consumption than these same hydraulic limes. Certainly all are familiar with such commercial successes as "Brixment" and its several imitations. The production of such hydraulic limes and natural cements more than doubled between 1919 and 1923—from

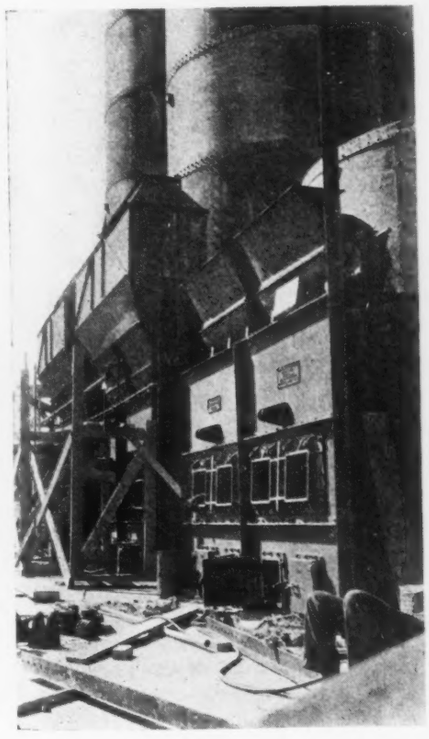
528,589 bbls in 1919 to 1,271,674 bbls in 1923, and the value was more than trebled. One of these manufacturers is about to put an interior lime plaster on the market which will have hydraulic properties and consequently be stronger and faster setting than any fat lime plaster.

Hydraulic Limes in Europe

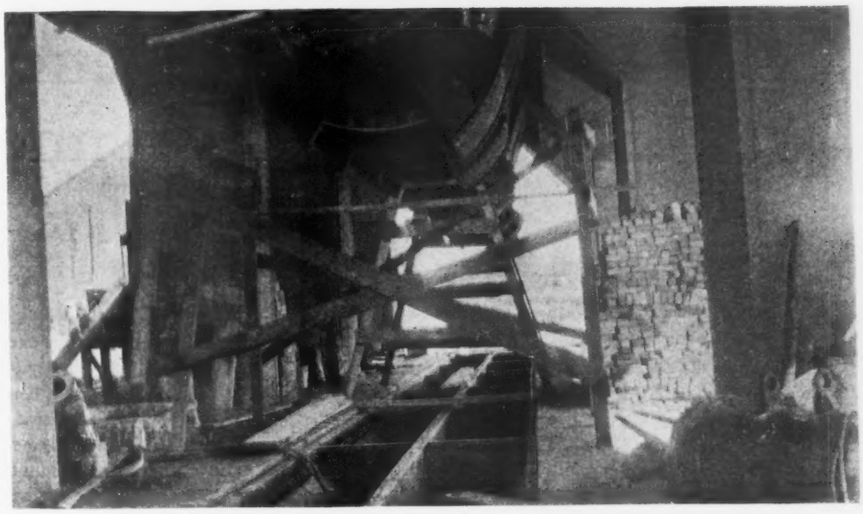
When Major Rowe, the English lime manufacturer said at the National Lime Association convention last spring that in England and on the continent it was impossible to have high calcium limes used in building work, the "dolomite fellers" erroneously applauded. But what Major Rowe meant was that hydraulic lime was required and not a product either of the finishing lime or the high calcium lime manufacturers, *per se*.

We believe if lime manufacturers will study the article of J. E. Duchez in Rock Products, December 13, on hydraulic cementing materials they will see that European lime manufacturers are several jumps ahead of them when it comes to the production and sale of *lime products*.

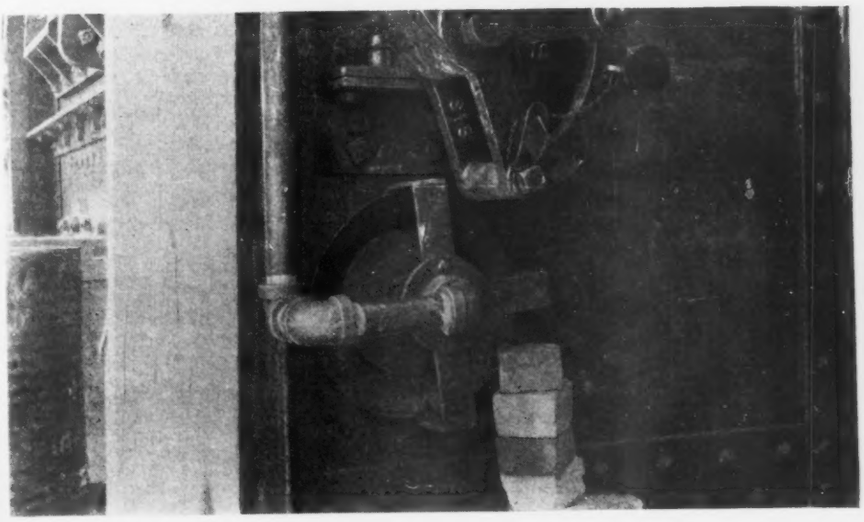
Rereading the foregoing we confess it looks very much like a harsh criticism of the lime industry. But we trust it will be accepted as constructive criticism; and we know as we write it that important developments are in the making, which if commercially successful, will answer our criticisms in considerable degree at least. Unfortunately, however, there is not as much interest in these developments by the rank and file of the industry as the splendid efforts of the National Lime Association to better the industry deserve.



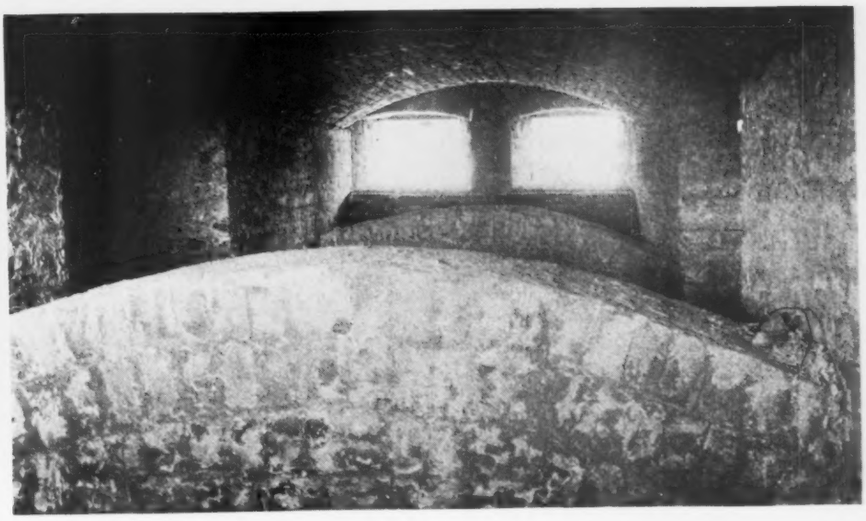
Furnaces with automatic stokers at Champlain Valley Lime Co. plant



Specially designed kiln draw shears and conveyor tunnel for lime



Specially designed air valve and steam inlet under grates



Large furnaces and remarkable arch spans in kilns

Some Improvements and Changes at The Rockland Lime Plant

No Longer Operated as Continuous-Draw Kilns—Other Changes—How the Barrel-Handling Plant Saves Labor

IN our first reference to the Rockland-and Rockport Lime Corporation's plant at Rockland, Maine, built in 1922, we expressed the opinion that the lime industry as a whole would derive much knowledge from experience in its operation. At least once a year since then the editor has made pilgrimages to Rockland to study new developments, and we believe, through the kindness and good nature of President George B. Wood, we have succeeded in keeping ROCK PRODUCTS readers fairly well posted on these developments.

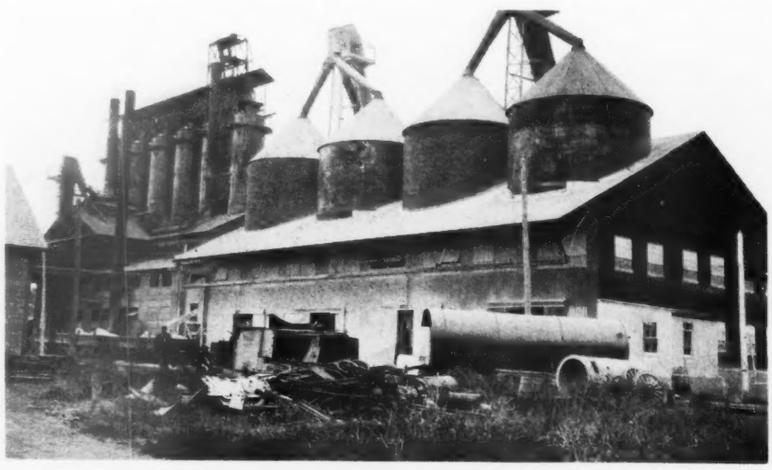
During the current year two notable changes have been made at Rockland. The six continuous draw gas-fired kilns are continuous draw no more. After much experimenting it was decided that they could be better operated by drawing at intervals as is standard practice. The combination of a gas-fired kiln of such a small diameter with a continuously open discharge at the base in a kiln, designed for internal combustion of the gas, proved to present insurmountable difficulties in the control of combustion—or the control of kiln temperatures. This was evident not only in the varying and unreliable character of the lime discharged, but in the kiln temperatures recorded by the pyrometers.

After experimenting with canvas hoods over the revolving open draw tables, as described in a previous issue of ROCK PRODUCTS, the kilns were one by one rebuilt by cutting off the lower ends of the cooling cones and equipping the cones with draw shears, as illustrated in one of the accompanying views. The kilns are now drawn at intervals of 2½ hours.

In justice to the original design, Mr. Wood expresses the belief that with small individual gas producers for each kiln, the principle of combustion and operation as originally intended could be put into very practical use, in the same manner as has been done at some other plants. The difficulty at Rockland all along has been the operation of a battery of six kilns from one producer. The inability to get draft regulation has been the principal difficulty. When only one or two kilns were operated remarkable fuel efficiencies were obtained.

Of course this change in the method of kiln operation necessitated a change in the method of moving the lime from the kiln to the pan conveyor which takes it to the storage bins and packing house. When the kilns were operated on the continuous draw basis the lime was discharged continuously from the draw tables on to the pan conveyor.

This lime was practically cold when it reached the conveyor. With 2½-houring over the kilns as described it was necessary to make the gas inlets combustion chambers. They are naturally too small for this purpose and considerable difficulty had to be overcome in making them serve the purpose. Air for combustion is now let in through the face of these chambers by adjustable slides or valves, illustrated in one of the views.



Plant of the Rockland and Rockport Lime Corporation, Rockland, Maine, showing new lime storage tanks

E. B. Packard, superintendent of the plant shown above

draw periods and the shortened cooling cone the lime is often drawn red hot. For cooling it and transferring it from the kilns to the pan conveyor, the all steel hopper-bottom dump cars shown in the illustration on page 93 have been installed. They hold about 3 tons each.

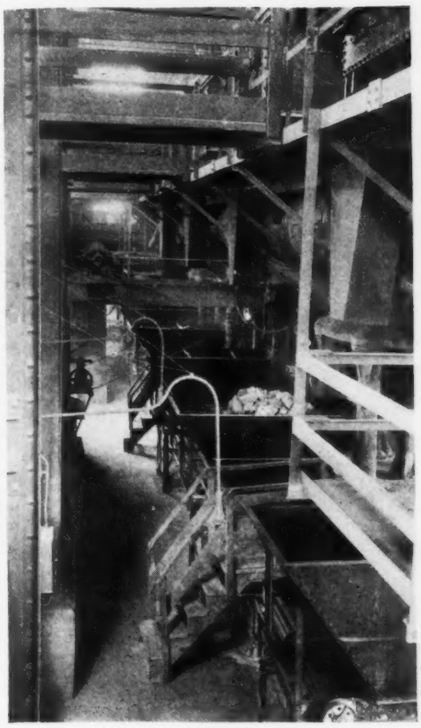
Combustion Chamber Difficulties

If the original design of these kilns is recalled it will be remembered that the air for combustion was to be drawn up through the cooling cone and mixed with the gas in the kiln, where the flame and combustion were to take place.

One great difficulty, of course, with these undersized combustion chambers has been to find a refractory that would stand up in the kiln arches. The latest attempt to meet this problem has been the installation of arches composed of three rings of carborundum brick, costing about $1.16 per brick.

Gas Pressure Control Refinements

Another problem in connection with combustion has been the control of gas pressure. The original design included a Chowning regulator, which had hitherto been used with much success on gas producers in the glass industry. It did not prove sufficiently sensitive, and during the present year this regulator has been replaced by a little device designed and built by the plant superintendent, E. B. Packard. This device, by means of a 1/15-hp. electric motor, drives a piston in and out with a worm gear; the piston



All-steel cars for removing lime from the kilns

moves a crank or lever which by means of cords and pulleys opens and closes a gate-valve on the steam main of the gas producer. The motor control reacts to changes in pressure as low as 0.01 in. as compared with regulation to 0.1 in. with the previous installation. The gas pressure, of course, corresponds to the amount of gas admitted to the kiln, so that this means a great improvement toward the control of combustion.

The combustion chamber and gas inlets are so constructed that air admitted through the adjustable valves already referred to passes over the top of the gas inlets and joins the gas at the arches, where combustion takes place. The last step in complete control of combustion is the placing of automatic draft controls on the kiln, similar to the present producer-gas pressure control, and progress is being made in this direction.

One other notable change has been made in the operation of the kilns. The screen in the chute at the top of the skip

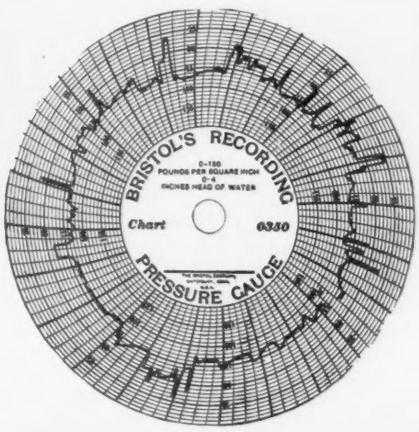
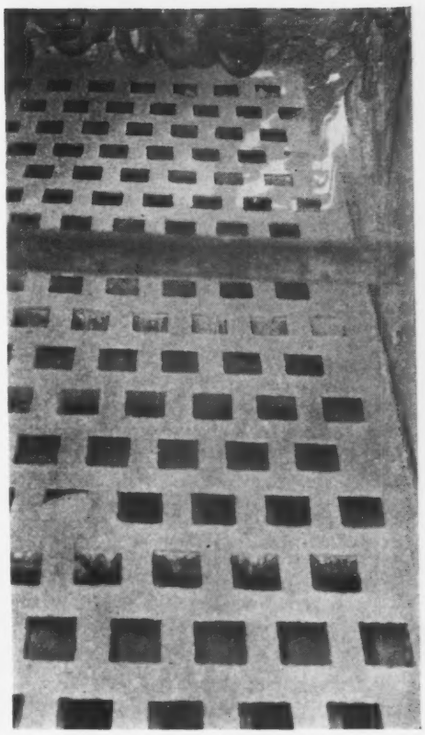
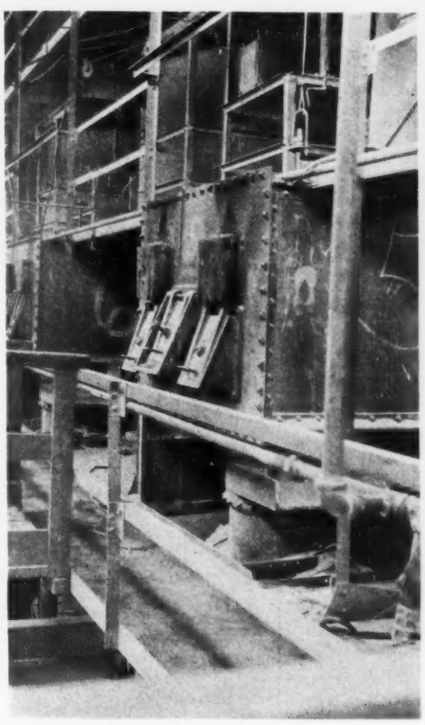


Chart showing fluctuations in gas pressure in main to kilns as originally operated

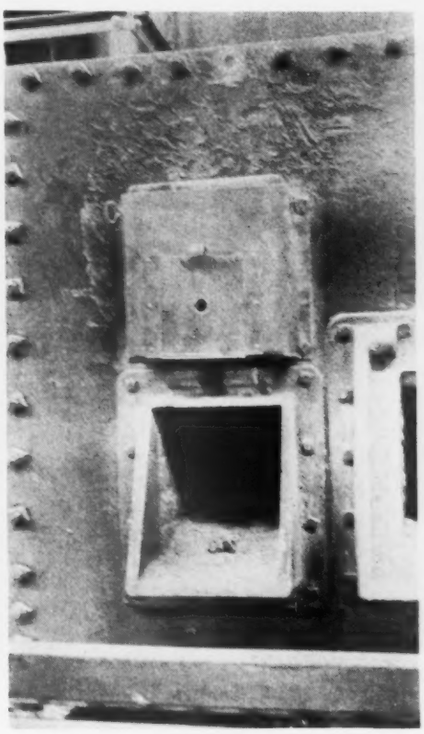


Manganese-steel screen plates in chute-feeding kilns

hoist into which the skips dump is made of manganese steel plates with 2½-in. square openings. The fines that pass these openings are chuted to railway cars, which are coupled to the tower crane. This eliminates the possibility of choking the kiln with small

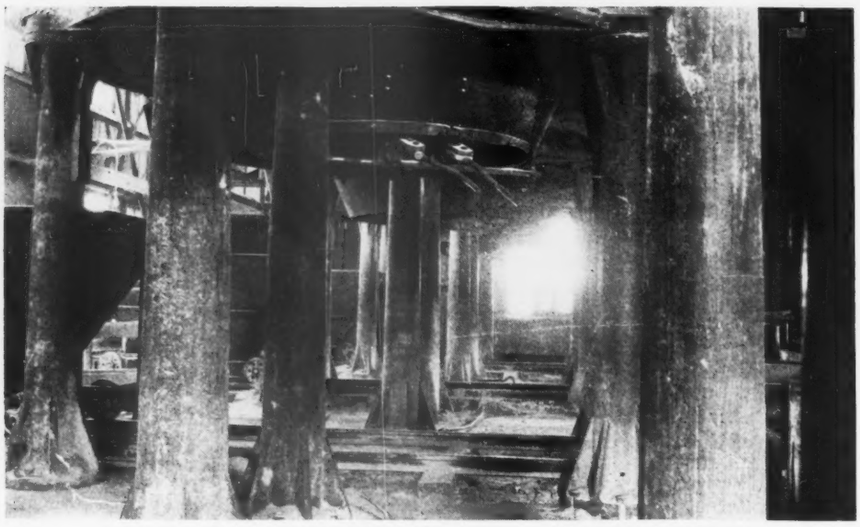


Gas inlets now used as furnaces, showing specially built air inlets

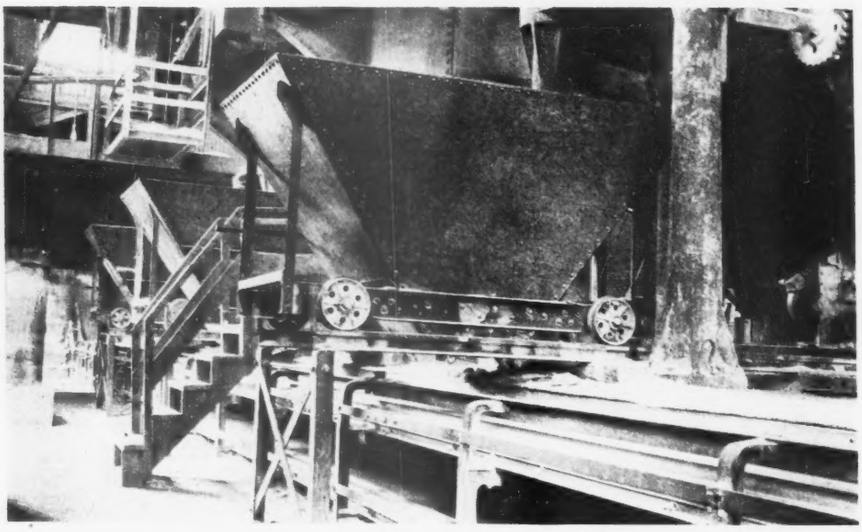


Air-control valve (above)—Door of clean-out hole below has been removed temporarily

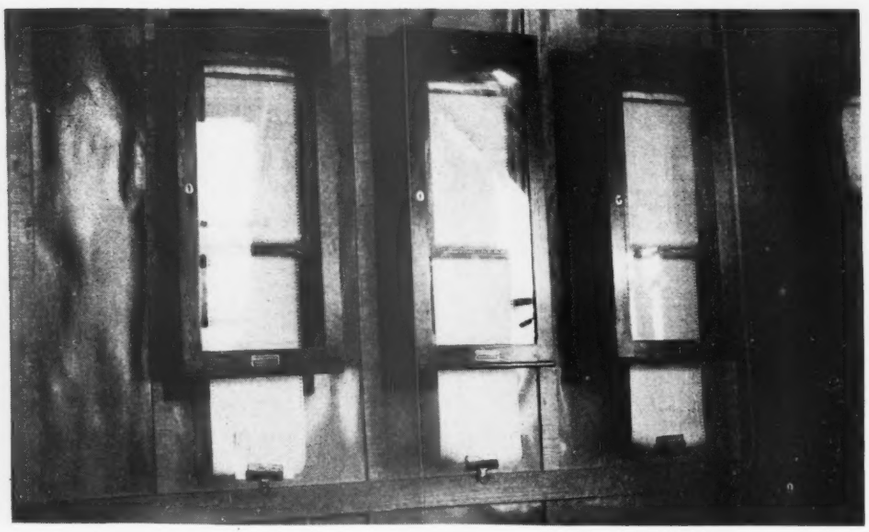
Arch ring of carborundum brick costing $1.16 per brick



Kilns with continuous-draw tables removed and shears added



Near view of hopper-bottom cars for cooling lime and feeding the pan conveyor



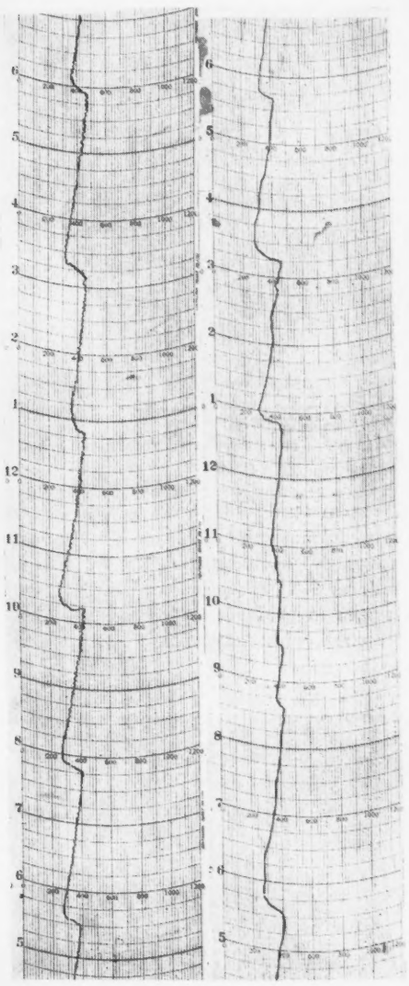
Recording pyrometers give a continuous record of kiln conditions

fragments broken off in the dumping operation.

Packing House

Two new steel storage tanks for lime have been added during the current year of 500 tons capacity each. The total storage capacity is now 2000 tons.

Minor improvements in the packing plant include the installation of a Sturtevant dust collector over the picking table (shown in the illustration) and the substitution of a



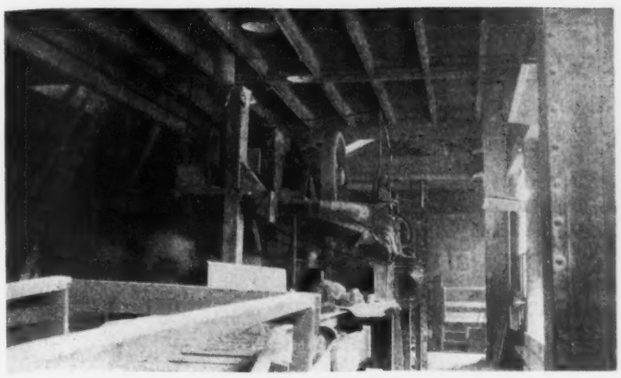
On the left is record of kiln exhaust gases as now operated with 2-hour draws; on the right is record as operated under the original continuous-draw method. Note the irregularity of kiln discharge and the continuous high temperatures over a long period

Cleveland worm-gear drive at the head of the pan conveyor, replacing the original geared drive.

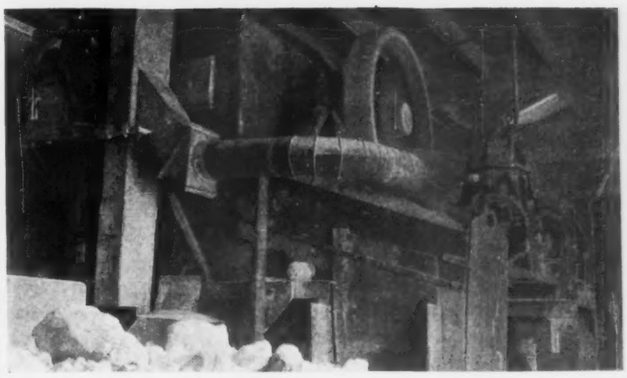
The main feature of this packing plant, which has now been installed long enough to demonstrate its value as a labor saver, is the barrel-handling equipment, which is described in the following paragraphs:

Barrel Handling

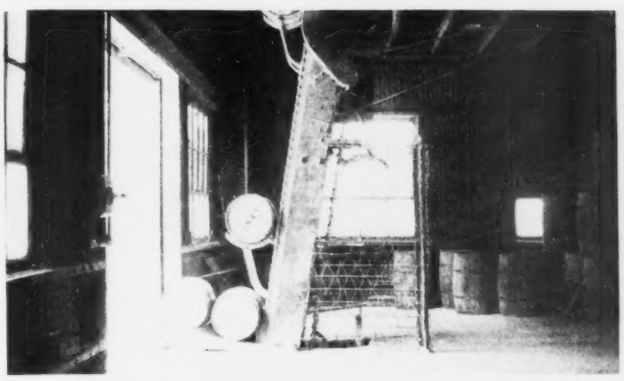
There is a cooperage plant of the International Cooperage Co., near the property of



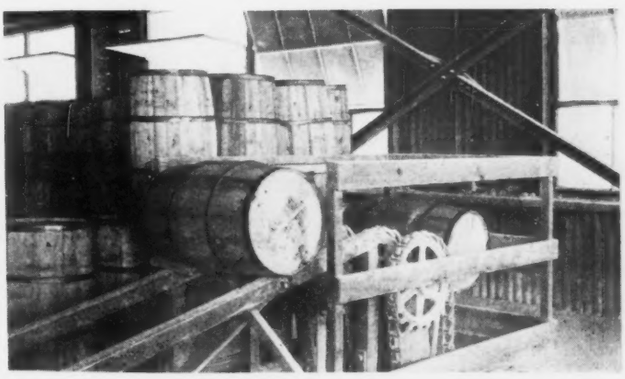
General view of conveyor head and lime-dust collector



Intake of lime-dust collector over picking table



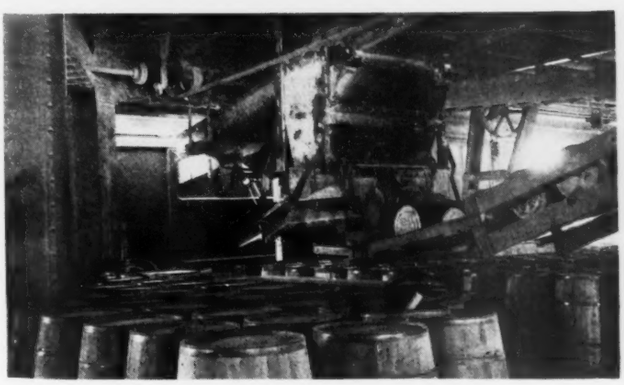
Empty barrels being received on ground floor of packing plant



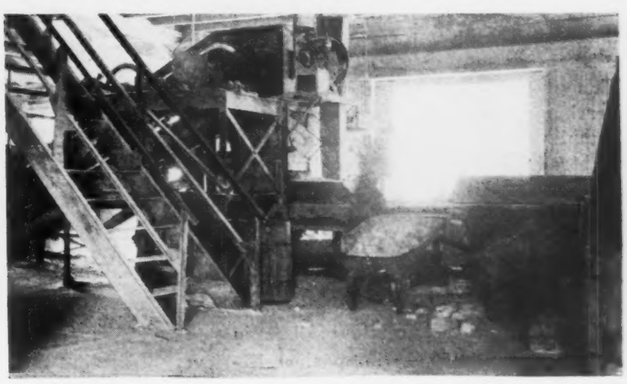
Barrels being automatically removed at top of elevator

Barrels stacked in loft over packing plant

Opening to runway leading to packing machines below



Foot of barrel runway and packing machine



Selected lime picked out on the way to the tank elevator

the Rockland and Rockport Lime Corp., at which the barrels are made and assembled. This barrel plant is but a few hundred feet from the lime plant. Transportation between the two is accomplished by an electric trolley railway.

The barrels are rolled from the trolley car to a barrel elevator installed by the Weller Manufacturing Co. of Chicago. At the top of the elevator they are automatically rolled off to the floor of the storage room, over the packing plant and under the lime storage bins. There is storage capacity for 8000 bbl.

Stacking is done by hand. When ready to use, the barrels are rolled to floor openings at the head of barrel chutes, where they go by gravity to the barrel-filling machines on the floor below.

This comes the nearest to being an automatic barrel-handling plant of any we have seen in the lime industry.

Agricultural Lime Prices Compared

THEORETICALLY, 100 lb. of finely ground limestone, 56 lb. of freshly burned lime, 74 lb. of hydrated lime and about 90 lb. of air-slaked lime have equal acid neutralizing power. In calculating the cost, the price of the material, the freight, if any, the cost of hauling and the labor involved in spreading it on the land should be taken into account. If finely ground limestone can be secured delivered at the nearest railroad station at $3 per ton, then, allowing for the smaller cost of handling equivalent amounts of the more concentrated forms, fresh burnt lime should be secured at the station for $6, hydrated lime for $4.50 and air-slaked lime for about $3.50 per ton.—*Bulletin of Purdue College of Agriculture.*

White Cliffs, Ark., Plant Sold to Lime Products Company

THE White Cliffs plant at Ashdown, Ark., and 2600 acres was sold in Ashdown by B. K. Walker, commissioner in chancery, to the Lime Products Co. of Fordyce, Ark., for $342,827, subject to the approval of the court. It is said that this company is composed of A. B. Banks and associates. They were represented at the sale by their attorney, T. D. Wynne.

This property was placed under a receivership some months ago on petition of employes of the Krippendorf-Tuttle Co., Martin Walsh being appointed receiver by the Chancery court of Little River country. The Bank of Fordyce was trustee for the bondholders.

Acetate of Lime Production Falls

PRODUCTION of acetate of lime in October was 9,603,414 lb., against 12,972,591 lb. in October, 1923, according to the Department of Commerce.

Reopen California Lime Plant

THE Cowell Lime Co. and its subsidiary, the San Benito Lime Co., owners of the quarry and kiln in the Cienega section near Hollister, Calif., announce the reopening of the plant within a short time.

Walter Sherburne, deputy county surveyor, and a crew of men are making the necessary surveys of the road, which will be improved at once.

The material is quarried, hauled to the kiln, burnt and hauled to Hollister. The company announces it will make another effort at securing a road between the Cienega and Tres Pinos, the end of the railroad. —*Hollister (Calif.) Advance.*

Russell Sage Foundation Suggests Way to Eliminate Labor Shortages

A GREAT DEAL of quackery and pseudo science is being exercised in the technique of selecting applicants for employment, and the greater part of the experimentation—scientific and otherwise—that has been carried on in regard to the selection of workers is still comparable to the "home remedies" stage of medicine and surgery, according to an exhaustive report on "Public Employment Offices — Their Purpose, Structure, and Methods," which has just been issued by the Russell Sage Foundation.

The value of the judgment regarding an applicant for work which is based on the look in his eye, the condition of his hands, or the condition of his collar, is minimized in the report, as is also the practice of arbitrarily classifying applicants for employment according to any standard list of types of personalities.

"No system or method of character analysis has yet produced results which justify its adoption or even suggest its trial in a public employment office," says the Foundation's statement. "This is not to be taken as decrying research in the field, but as a warning against depending too much upon any schemes for rating individuals which appeal to the imagination because of the greatness of the need for something of the kind, rather than because of their demonstrated success.

"The human mind has been grouped by some persons interested in employment questions into types that are presumably mutually exclusive as follows: the executive type; the detail type; the promotion type; the accounting type; the clerical type; the selling type; the mechanical type, and so on. These adjectives do describe attributes of the mind, but that people can be so tagged and labeled fairly is doubtful. The temptation to label people is very great, but the science and art of successfully doing it have not as yet been discovered."

The report, which is based on a five-year study extending into almost every state in the union and into Canada and England, was prepared by Shelby M. Harrison, director, Department of Surveys and Exhibits of the Russell Sage Foundation, in collaboration with Mary LaDame, Bradley Buell, Leslie E. Woodcock, and Frederick A. King, all of whom have been closely identified with public and private employment work. Several hundred pages in the report are devoted to methods of organizing and administering a national employment service.

In making the report public, Mr. Harrison said: "The solution of the employment problem depends very largely on the ability of the staff in each local office—and there would be a hundred or more of such offices in the proposed service—to discover, as intelligently as possible, the exact requirements of the job which the employer wants filled, and the capability and adaptability of the individual worker applying for this job."

After reviewing the various methods by which workers get jobs and employers get workers, the report draws the conclusion that these methods are inadequate to the needs both of industry and of the workers; it recommends the establishment of a nation-wide free employment service to be operated jointly by the federal, state, and local governments, and cites the following major reasons for the need for such a service:

(1) All of the existing employment agencies combined meet only part of the need, and they leave the employment service demands of many important sections of the country and some important industries entirely undeveloped.

(2) In order to reduce unemployment, and at the same time give employers the maximum assistance in securing labor, there is need, among other things, for an employment system national in scope. None of the existing non-governmental agencies offer sufficient promise of development along these lines; nor is there at present any means of co-ordinating or correlating the activities of the existing agencies.

(3) It is necessary, particularly during periods of strike or other active controversies between employer and employe, to have absolute impartiality and this cannot be secured through the existing agencies; methods of attaining impartiality through a combined federal-state-local system of public employment offices are pointed out in the report.

Where the Asbestos Goes

ASBESTOS producers owe their fortunes in large part to automobiles. Autos take 50% of asbestos products annually. Annual consumption of asbestos brake linings is estimated at 70,000,000 ft.

The Crushed-Stone Industry in 1924

General Business Increased Probably About 10%, but Flux Producers Had a Lean Year and There Is Evidence of Tendency Toward Overproduction; Some New Developments

CRUSHED stone enters so many fields that it is hardly to be expected that all these should flourish simultaneously. Indeed it might be a very bad thing for the industry if there should be such a coincidence. It might encourage production beyond any really *normal* demand.

Thus while general building and highway construction caused large demands on crushed stone producers in 1924, the slump in iron and steel production had an appreciable depressing influence on production at quarries where a considerable percentage of normal business is flux stone. Ohio quarries and those about Pittsburgh in Pennsylvania and West Virginia were the worst sufferers; and apparently the demand for highway stone in Ohio was not up to the demands in neighboring states, or it was distributed among a larger number of producers.

In general, the expected volume of railway ballast business did not materialize—evidently because the railways desired to hold up large improvement programs till after the presidential election. In some sections, notably in Iowa, there was not a normal volume of highway construction, owing to the feeling of poverty on the part of the large percentage of the rural population.

Notwithstanding all these drawbacks, we venture to predict that the production of crushed stone in 1924 exceeded the 1923 production by approximately 5%. Some 70% of the producers reported more business than in 1923, about 30% reported less business. The total volume of the crushed stone business in 1923 was 88,000,000 tons.

Prices Stable

Prices, in general, were remarkably stable. We had predicted a slight drop in prices during 1924 on account of a tendency toward overproduction, but in most cases prices continued on approximately the 1923 level. Where lower prices were reported they were apparently due entirely to local conditions. There were some instances of lower prices, with approximately the same production costs, but these were offset by higher prices in other localities, so that for the industry as a whole we are safe in saying that the margin of profit in 1924 was approximately the same as in 1923, and owing to a greater volume of business gross profits were probably above those of 1923.

Producers are quite unanimously of the opinion that conditions will not change materially in 1925. An annual growth in production of about 10% is looked for and this opinion reflects a healthful state of the industry. Business prophets in all lines are looking forward to the maintenance of the present pace in building construction, and highway construction next year bids fair to be considerably better in many states than it was in 1924.

No Labor Shortage

There was no shortage of labor in 1924 and none is generally expected in 1925, notwithstanding the effect of the new immigration law, which will begin to show results by then. There was practically little change in wage schedules as between 1923 and 1924 and no appreciable changes are looked for in 1925. Producers seem to have accepted a high wage scale all around as an important factor in general prosperity.

However, some of those who have given the subject of labor the most study are apprehensive that we may be faced with a growing shortage of common labor, particularly in the East, which has always been more dependent on immigrant labor than the rest of the country.

In spite of the fact that there has been no superabundance of common labor, the efficiency of such labor has in general improved. Some producers attribute this to the greatly increased use of labor-saving machinery, which they say has also been an important factor in preventing labor shortages.

Big Investments in Existing Plants

Our conclusions from editorial travels and observation, that by far the largest part of the investment being made in the crushed-stone industry this year is for additions and improvements by established producers, are verified by the observations of 75% of the producers reporting. There have been some notable exceptions and these are referred to in detail later on.

Only about half of the producers reporting were willing to commit themselves to a specific answer "yes" or "no" on the justifications for further expansion at the present time. Twice as many of these said "no" as said "yes." But all producers, apparently, are unanimously of the opinion that more investment should be directed toward perfecting and cheapening present production methods.

In other words, the crushed-stone industry is not very "bullish" on prospective production. Doubtless we all have in our subconscious minds the same idea expressed recently by the president that these times are too good to last indefinitely. The most interesting phase of the general attitude toward reducing costs by investment in improved facilities, as we see it, is the universal acceptance of the belief that present costs *can be reduced* without reducing wages. Doubtless it is also evidence of a general belief in approaching competitive conditions which will require more attention to costs.

Freight Rate Problem

A majority of those reporting are in favor of a mileage scale of freight rates. Mileage scales of general application are already in effect in West Virginia, Minnesota, Nebraska and northern California, and in every instance producers in these localities report in favor of such a basis of rates. As this problem of freight rates in both the crushed-stone and sand and gravel industries is discussed in more detail elsewhere in this issue, we will drop the subject here.

Tendency Toward Large Plants

Producers, with very few exceptions, verify our own observations in the present tendency toward large units of production, and state that the reasons for this are the constantly increasing demands for better products, or at least more-processed products, as well as a greater variety of products. The effect of high-priced labor is quite generally believed to favor such larger units, although about one-third of those reporting did not believe the labor situation had anything to do with this tendency one way or the other.

A great variety of opinions is expressed as to the greatest advance made by the crushed-stone industry during 1924—better competitive conditions, improvement in power shovels, batching devices at producing plants, advance in labor-saving devices and installations, better construction of highways, the increased efficiency shown by established plants, better labor efficiency and more uniformity in product.

Quite a few producers believe that the biggest problem facing the crushed-stone industry today is the readjustment of freight rates, and with this we are inclined to agree. The industry must obviously prepare itself to take some harmo-

nious stand on this subject because the decision reached by the powers-that-be will undoubtedly have far-reaching effects; and it would seem that the industry ought to have some definite idea of what it really does want.

Some of the other problems suggested are the prevention of overproduction, the establishment of a more direct contact with engineers and highway departments, the education of highway officials in the use of better materials, a standardization of products, the maintenance of a longer operating season, finding methods of lowering costs, getting more intelligent supervision of highway work. Some of these are obviously of merely local interest, but others touch on general conditions.

A growing community of interests, because of affiliated ownership, between crushed stone and sand and gravel producers is seen by six out of every seven producers who commented on this plane of the industry.

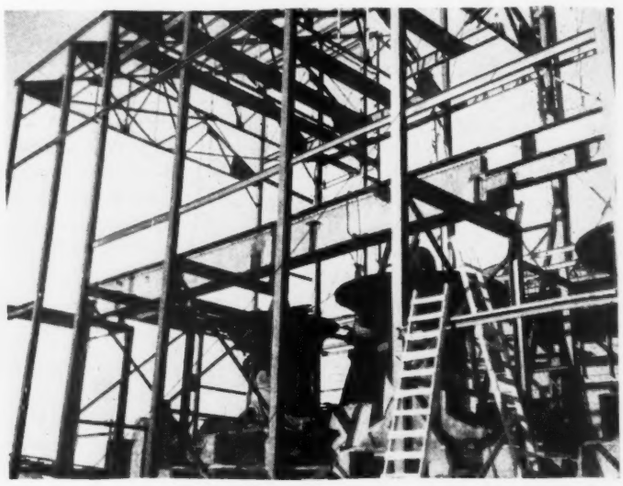
Technical Developments

Looking back over the year we fail to see any outstanding technical development, unless it is the tendency to build crushing plants in greater harmony with modern ideas of fireproof or fire-resisting mill construction. The year was marked by disastrous fires at several well-known plants. In nearly every case rebuilding has been done in steel and concrete.

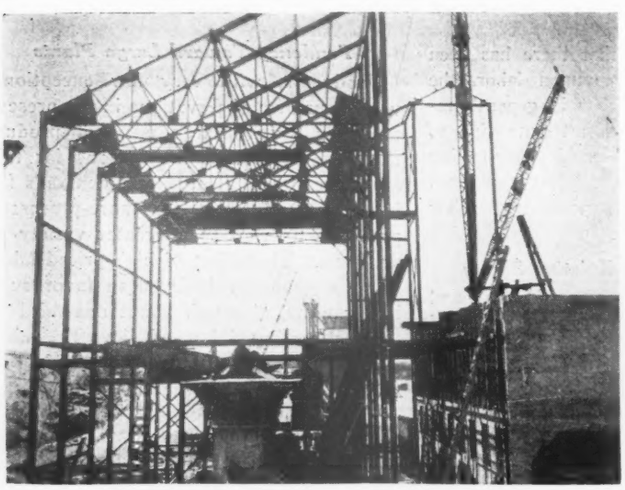
These new modern plants of old established producers are of peculiar interest to the industry not merely from the fact that they are being rebuilt as permanent structures but because the operators are taking advantage of their temporary misfortunes to incorporate in these new plants many improved methods and labor-saving devices developed through many years' operating experience. Examples of such plants already described in Rock Products are those of the Mid-West Crushed Stone Co. at Greencastle, Ind. (issue of September 6) and the Bound Brook Crushed Stone Co. plant at Bound Brook, N. J. (issue of November 1).

Three notable plants are now in the process of rebuilding—the Akron, N. Y., plant of the General Crushed Stone Co., the Krause, Ill., plant of the Columbia Quarry Co. and the Hillsville, Penn., plant of the Carbon Limestone Co. Vice-President Krause of the Columbia Quarry Co. writes: "I believe we are going to have the most modern plant of its size in the country. It will be strictly fireproof, with no wood whatever—not even enough to make a box of matches. It will have a No. 18, a No. 8 and two 10-in. reduction crushers (all gyratory), a washing plant and new equipment throughout, new cars of our own design, gasoline locomotives, four shovels (one of them electric). There will not be a conveyor in the plant. There will be 12 bins and two track scales." We believe this typifies the attitude of experienced producers toward the future of the American quarry industry.

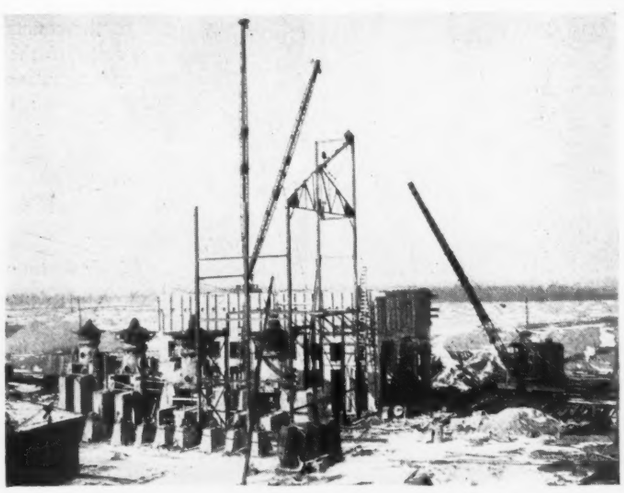
General view of new Akron, N. Y., plant of the General Crushed Stone Co. under construction



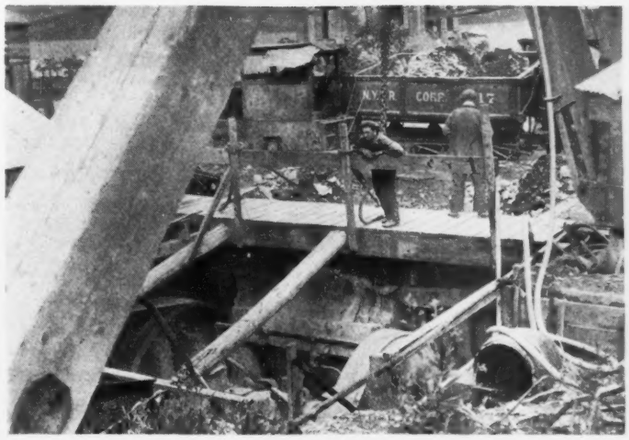
Crusher building showing battery of gyratories in structural steel frame



Another view of the crusher building



An earlier view showing relation of crushers and bins

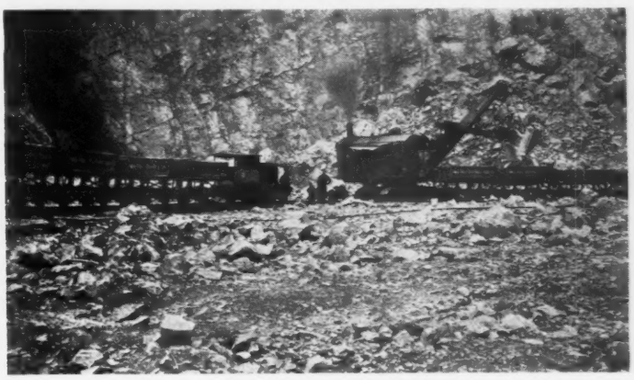


New primary crusher installation at Cedar Cliff plant of New York Trap Rock Co.

Type of transportation equipment used at the Cedar Cliff quarry

Otho M. Graves, assistant to the president of the General Crushed Stone Co., sends the accompanying progress pictures of the new Akron plant. He writes: "As indicated in the photographs, the bins are all reinforced concrete and the crusher building is of structural steel. We are endeavoring to so rebuild as to prevent a recurrence of the fire which destroyed the previous buildings. The capacity of the new plant should be about 4000 tons daily."

Heavy rails and point switches for quarry tracks



Train always waiting at the shovel

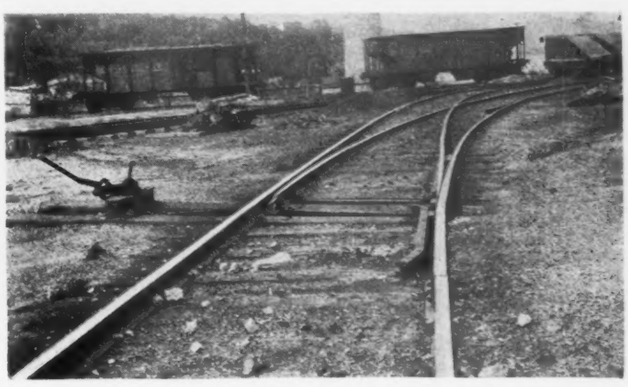
Increasing the Efficiency and Capacity of Existing Plants

Another type of improvement work which we believe shows the general tendency of well-seasoned producers is that done by the New York Trap Rock Co. at its Cedar Cliff plant, illustrated herewith. An entire new 48x60-in. Traylor jaw crushing unit, with scalping screens, re-crushers, second scalping screens and additional sizing screen, was added to the existing plant as a practically independent unit. This leaves the old crushing plant intact to use in an emergency, or to use simultaneously with the new unit to increase plant capacity, giving much desired elasticity to the operation.

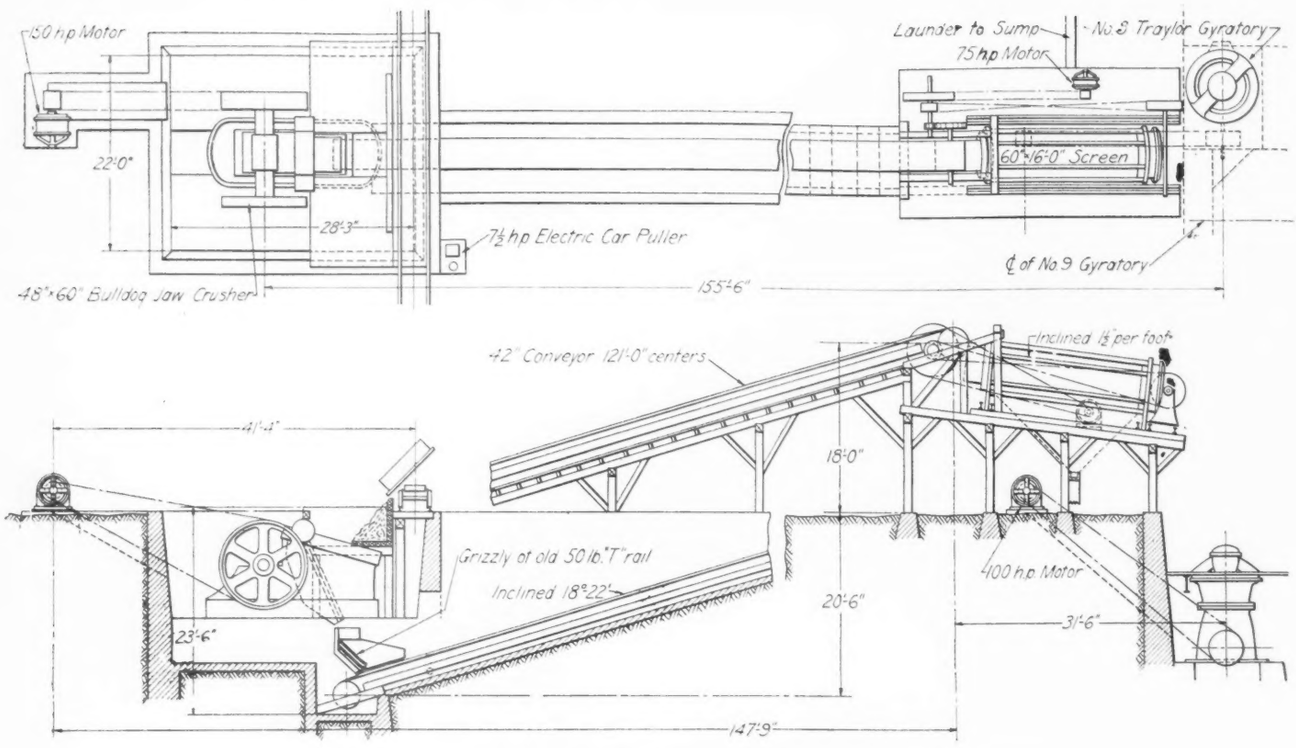
Most interesting at this plant, however, is the quarry operation which has been converted from a hand operation to an ultra-modern mechanical operation. The old quarry had the usual fan-shaped track layout and mule-operated cars. The new track layout shows unusual skill and foresight for the utmost economy and greatest possible production.

There are three distinct units in the quarry-operating scheme, three Cyclone well drills, three No. 50 Bucyrus steam shovels, three separate and distinct closed loop tracks, each serving one shovel, and six 5-car trains (Western 5-yd. dump cars), drawn by 9-ton Whitcomb gasoline

Example of railway track at Tomkins' Cove quarry



Standard gage track fit for any railway operation

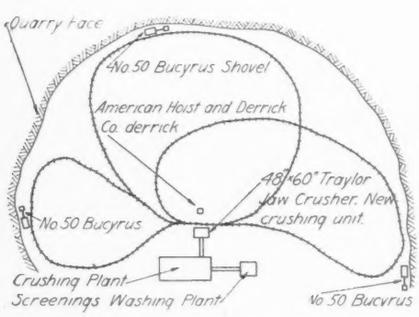


Plan and elevation of new primary crusher installation at Cedar Cliff quarry

locomotives. The track is made of 70-lb. steel rails, with point switches and is kept in first-class condition for a quarry operation.

Adequate Quarry Transportation Facilities

As the writer watched this operation on a busy fall day he was struck by the fact that an empty train was almost invariably waiting at the shovel for the last car of the preceding train to be filled, and that a loaded train was always right behind the

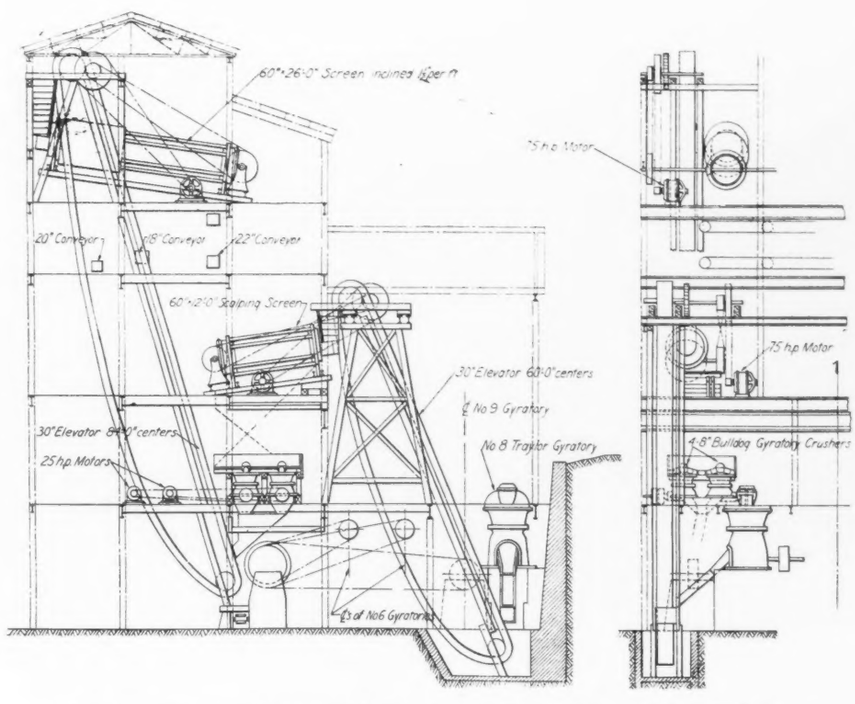


Sketch plan of quarry trade layout at Cedar Cliff

train leaving the crusher. He recalled other quarry operations and the thought came to him that many operators in order to save the cost of an extra train or two were paying many times over the cost of the train and locomotive driver in lost time at the shovel and lost energy in a crushing and screening plant running empty at intervals. Apparently investment in track and trains is a mighty desirable investment. P. J. Gilcrist, superintendent, told the writer that he had put 3700 cu. yd. through this plant in a 10-hour day.

In handling the trains the locomotive drivers are given considerable leeway and use their own judgment as to which shovel they will take the train to for loading. The whole quarry operation is visible from the crusher dump. Consequently if there is a delay at any one shovel the trains would not pile up there through any routine method of train control.

The same idea of adequate track and train facilities was observed at the Tomkin's Cove Stone Co. plant at Tomkin's Cove, N. Y., only here the tracks are



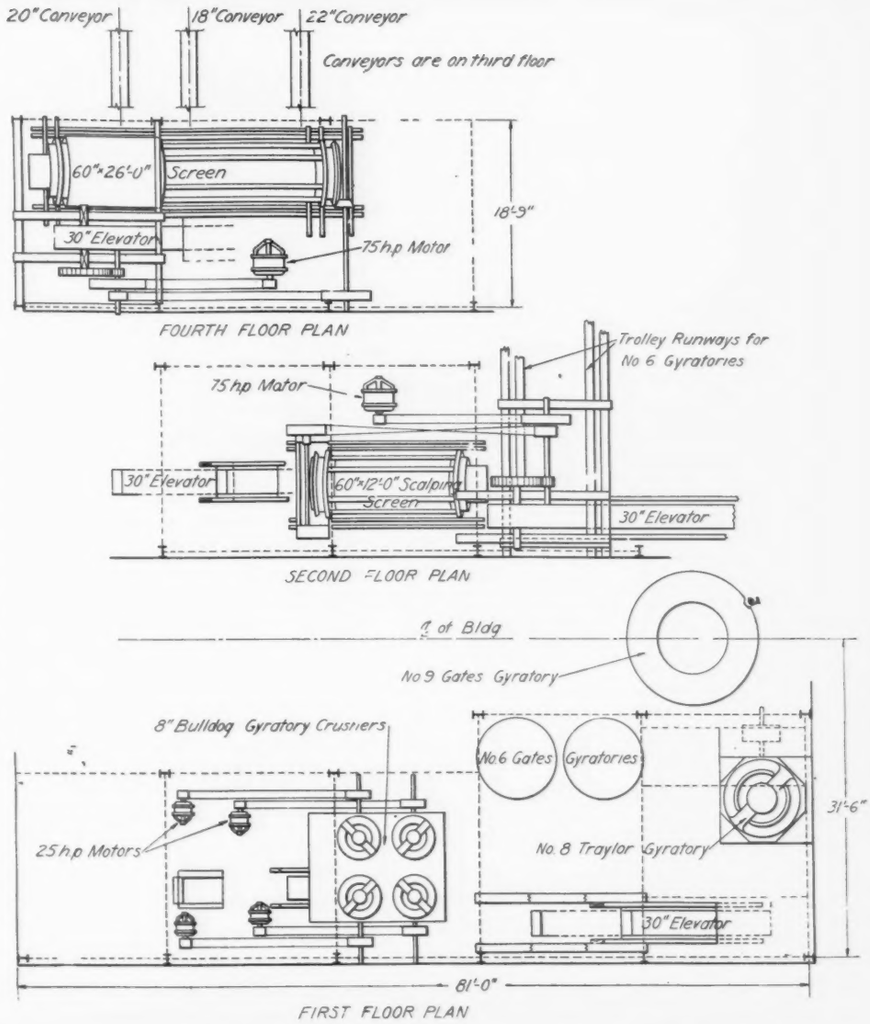
Elevations of secondary crushing and screenings units at Cedar Cliff plant

standard gage and 40-ton steam saddle-tank locomotives are used for haulage on the upper level and geared locomotives on the lower level. The ballasting and alignment of tracks would do credit to a regular railway and represent an economy proved by many years' operation of a very successful operator.

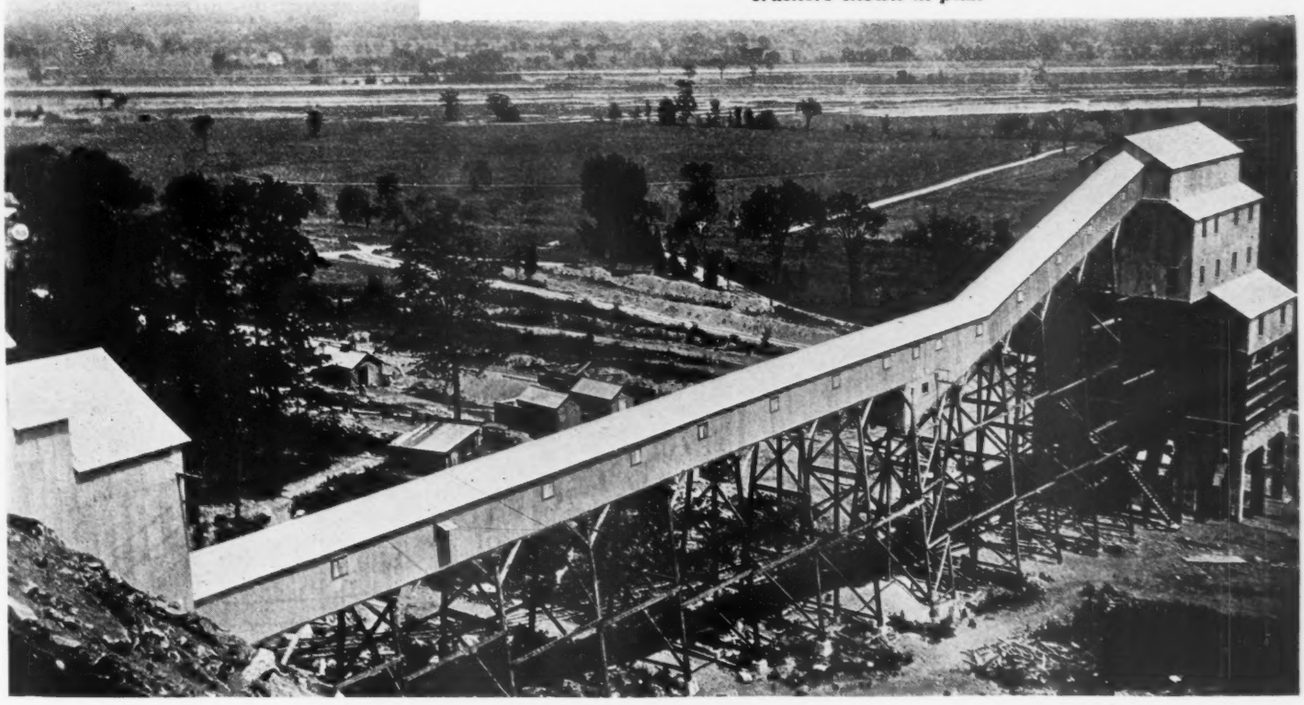
The three new plants which stand out in the year's resume of developments are those of the Albany Crushed Stone Co. at Feura Bush, N. Y., the Consolidated Crushed Stone Co. at Smithville, Mo., and the Zenith Limestone Co., Tulsa, Okla. These three represent the efforts of newcomers in the industry and in each no expense was spared to give what the owners believe are the best in the industry. We will describe these plants in detail in subsequent issues, so that here we shall refer only to some of the outstanding features.

The Albany Crushed Stone Co. operation is notable as having an apparently well-designed crushing plant. While it lacks the elasticity of being able to recrush or reprocess stone that has once gone through the mill, that is demanded by experienced operators, it is the intention to provide for fluctuating demands for particular sizes by ample storage facilities and to crush, as the crushing of this particular stone is most economically done.

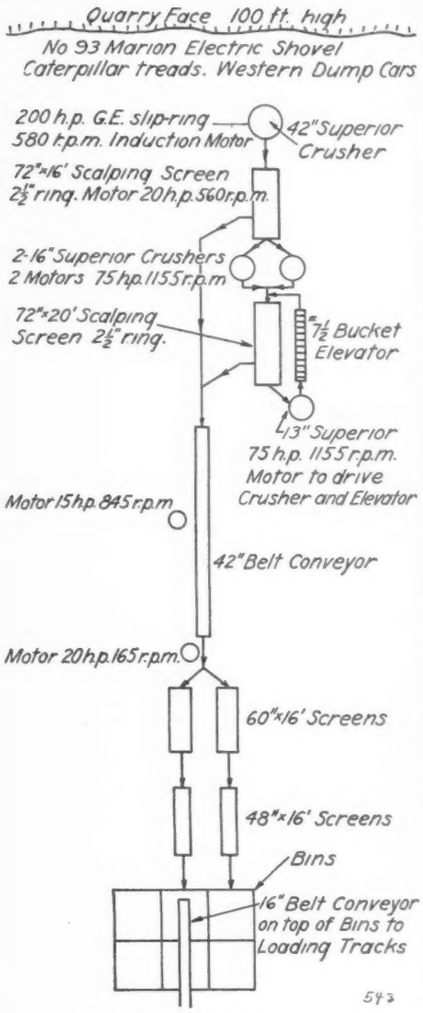
No crushed stone plant in the industry is more strategically located than this, as the sketch herewith shows. The rail connections give access to a great territory which certainly offers great potential pos-



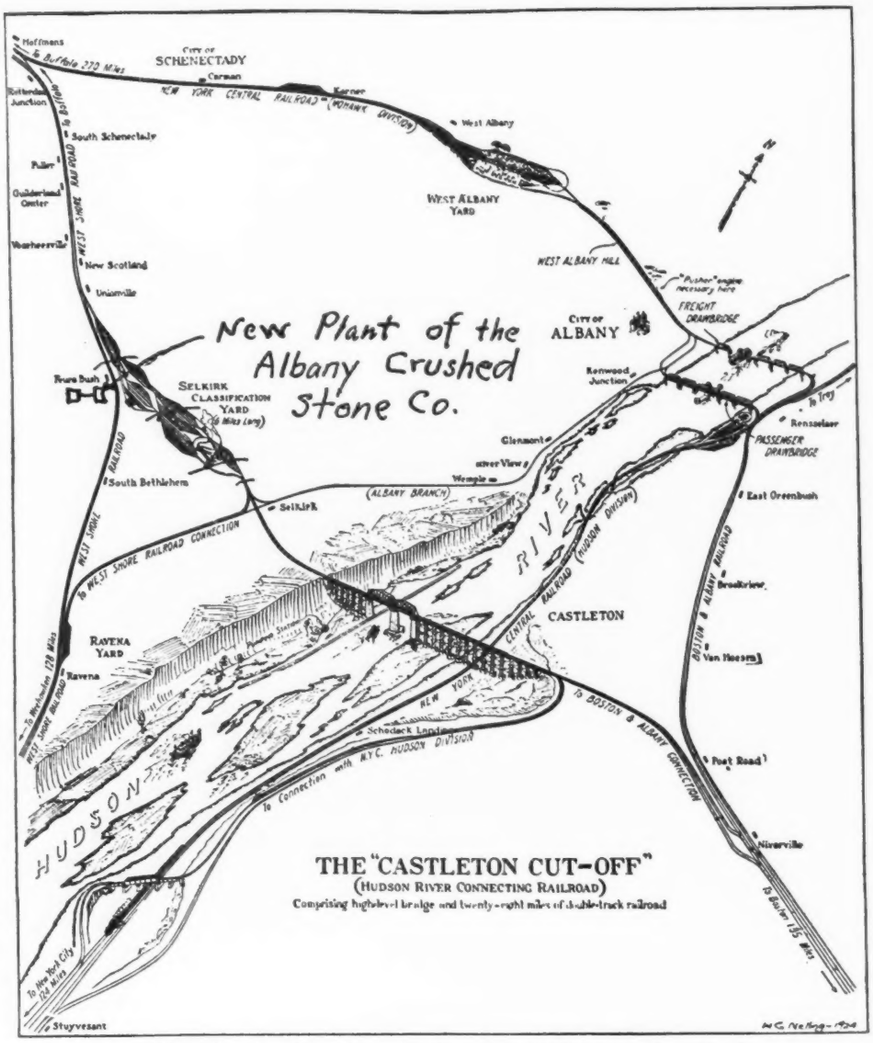
Plan of new secondary crushing and screening units, with three old crushers shown in plan



General view of crushing plant of the Albany Crushed Stone Co., Feura Bush, N. Y.



Flow sheet of Albany Crushed Stone Co. plant



Map showing location of Albany Crushed Stone Co. plant

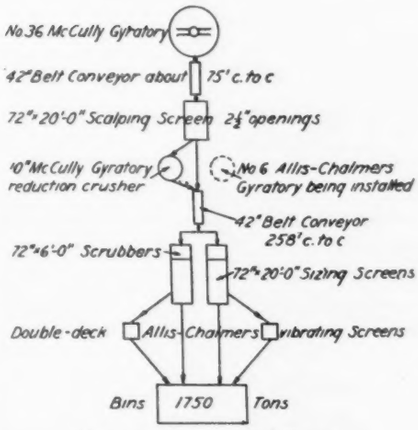
Panorama of the new plant of the Consolidated Crushed Stone Co. of Kansas City, Mo.

sibilities of development. Under the remarkably pure limestone is a thick bed of shale, so that it is not unlikely that at some future date this operation will develop into a portland cement plant.

The Consolidated Crushed Stone Co. plant is most interesting because of the conditions under which it was financed and built by R. Newton McDowell of Kansas City, Mo. Mr. McDowell was inexperienced in the quarry industry, but he had visions of the coming demand for crushed stone in the great program of highway development entered into by the state of Missouri and the apparent inability of present and projected plants to meet this demand. He succeeded in securing a contract with the state highway department through which about a quarter of a million dollars was advanced by the state toward the construction of the plant.

Mr. McDowell very frankly explained this contract and his plans in a letter to Rock Products, published in our issue of June 14. While he has naturally met with a most determined opposition on the part of established producers in Missouri, he has given evidence of both courage and foresight and that the crushed stone industry of the country at large will surely be interested in the way in which he meets the problems he is at present confronted with.

The accompanying flow sheet of the Smithville plant and the panorama describe it sufficiently at this writing to give our readers the impression that it is undoubtedly the largest and most modern crushing plant in the territory west of Chicago and east of the Pacific coast. (It was designed by the Allis-Chalmers Manufacturing Co.) In his quarry operation



Flow sheet of Smithville plant

here Mr. McDowell is meeting with serious obstacles in the way of shale seams and irregular formations, yet he is meeting them with a determination to succeed if money, brains, and industry can make a success under these conditions.

New Oklahoma Plant

For a description of the new plant of the Zenith Limestone Co., Tulsa, Okla., we are indebted to W. J. Cavanagh, engineer, Kennedy-Van Saun Manufacturing and Engineering Co., New York City, designer of the plant. We quote from his letter of December 18 as follows:

"This company is owned entirely by R. D. Long, who is the vice-president and general manager, and Harry Bell of Muskogee, president.

"It is a side-hill proposition; it was intended for an absolutely gravity-operated plant. The hill in the lower part is of a soft shale, which rises to a height of something over 100 ft., and on top of this there is some 50-odd feet of well-stratified high-calcium limestone.

"There is very little overburden to be handled and the principal developing operation is simply to straighten up the front of the face, and this is about accomplished now, so that they have a very fair quarry face at this time of approximately 40 ft. in height, and some 250 ft. in length. All the tracks in the quarry are of standard gage, and, for the present, a 1½-yd. bucket is being used on their steam shovel. Later, a larger shovel is to be put in as their intention is to produce at the present 1500 tons per day, and later increase the capacity to twice that amount.

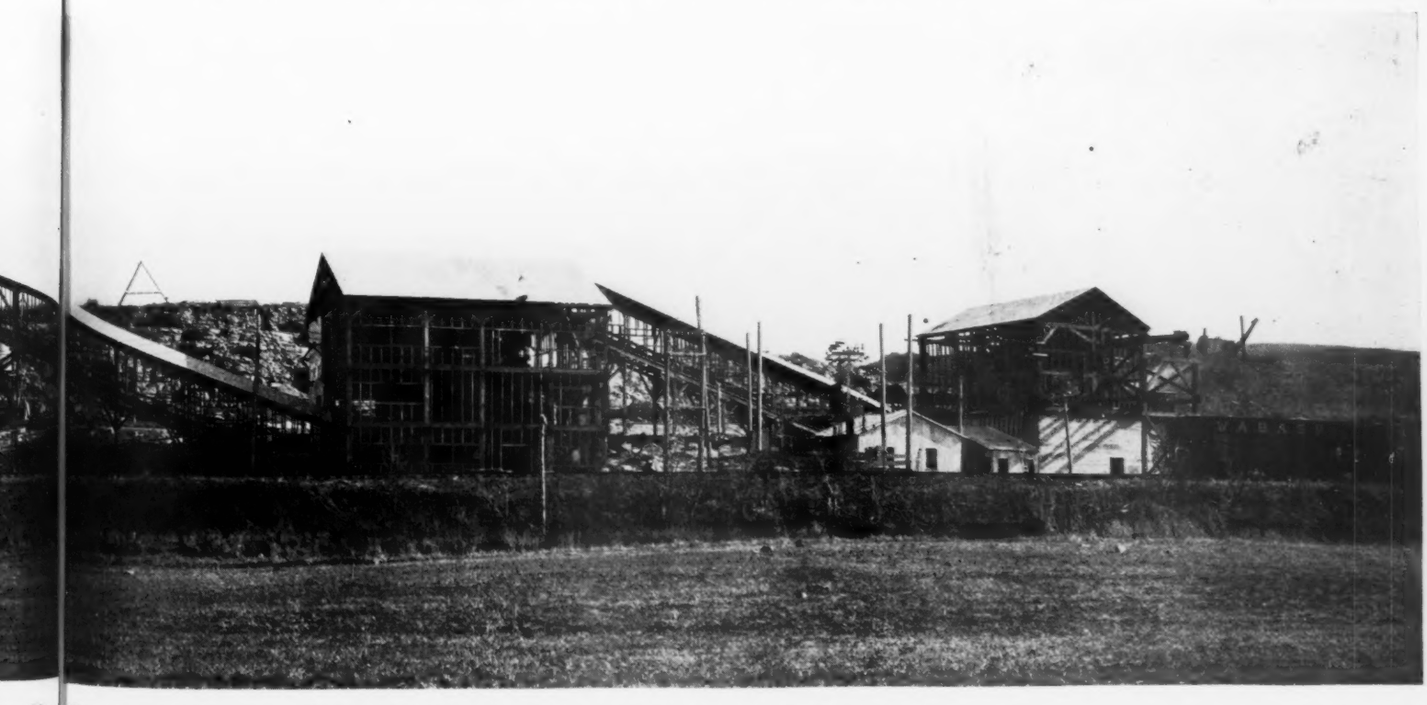
"All the cars used in the quarry are specially designed by Mr. Long, and are really flat cars with the exception that one side of the car is left on, but both ends and the other side are open.

"There are in use, when operating just now, 12 cars. The bottom of the car is made of 6-in. timbers covered with a 1-in. thick steel plate. The side of the car, or as you might call it, the back of the car, is also lined with boiler plate.

Plow Unloaders

There are four cars left by the steam shovel, being loaded while their engine hauls four cars to the crusher, leaves them there and takes back to the quarry the four empty cars which have just been unloaded. Above the quarry floor Mr. Long has designed an immense plow, which is suspended on cables so that the bottom of it is on a level with the floor of the car, and as the car is pushed forward the plow scrapes the material off into the initial crusher.

"At the end of each car there is a steel



Mo., at Smithville, Mo., about which there has been much controversy in Missouri

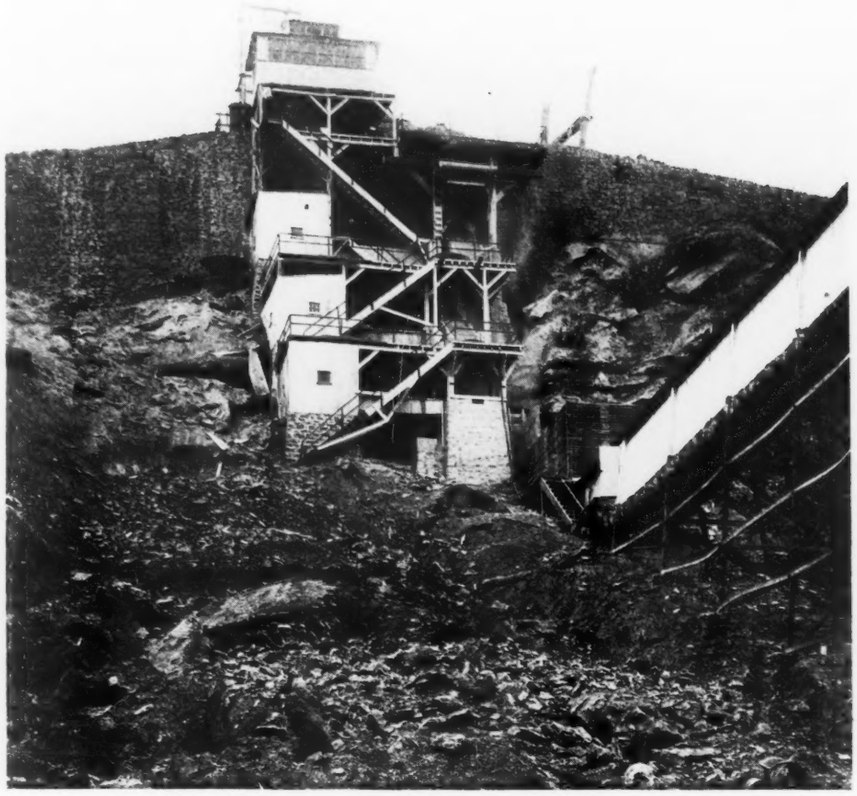
apron which fits over to the next car so that the four cars are pulled continuously under the plow, and thus the crusher is fed in a uniform manner, and the arrangement by which they move the cars under the plow is in itself a feeder, and never at any time is there a whole carload dumped on the crusher, as is usual in most plants. These cars carry about 30 cu. yd. each, and if they were to be dumped on the crusher at once it would necessitate a gang of men around the crusher to pull and haul the rock with hooks so as to uncover it. Whereas, with this method, the crusher is never smothered.

Foundation Troubles

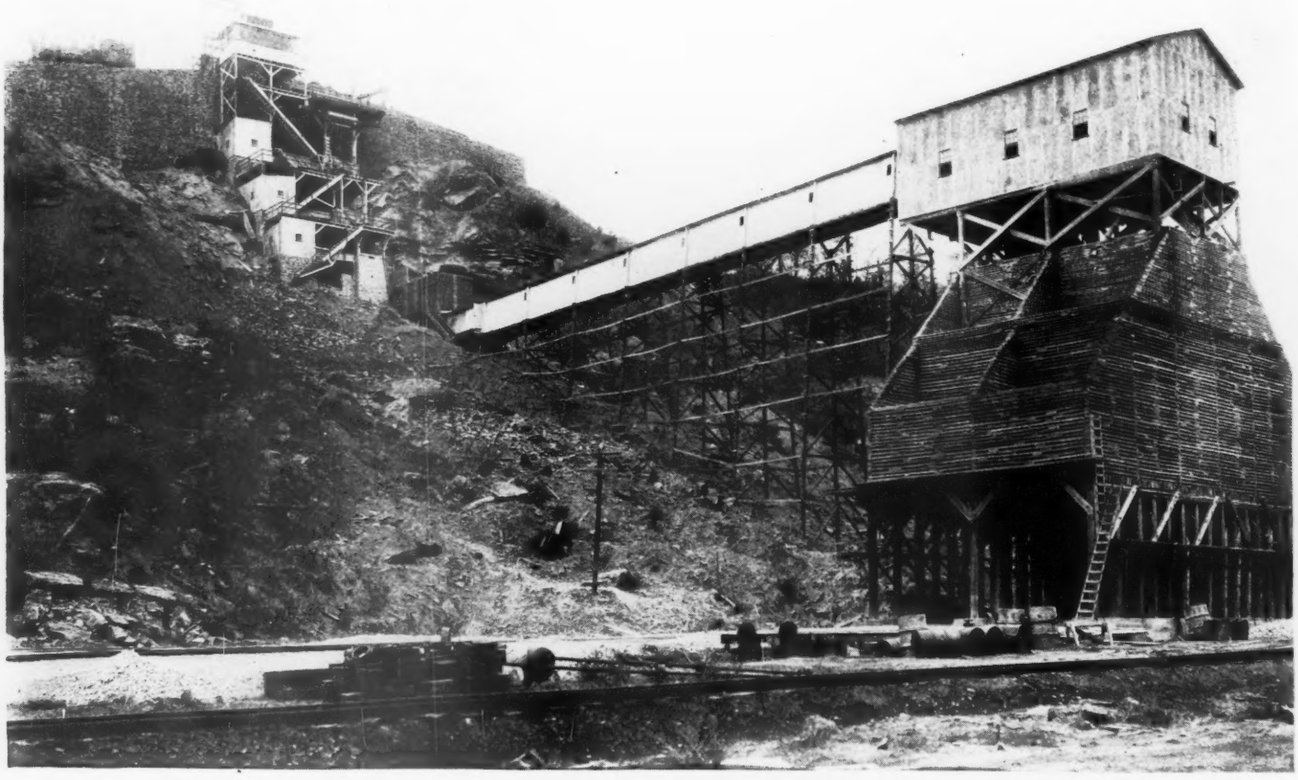
"When they started digging for the foundation of the bin they found that the shale had a tendency to slip, and in fact they did at one time have a regular little 'Culebra cut,' and as a result they were compelled to remove something like 150,000 yd. of shale. Then it was decided to move the bin out and away from the hill and erect a 30-in. conveyor about 200 ft. long to convey the stone from the crusher to the screen.

"The primary crushing plant consists of a No. 30 Kennedy gearless crusher, set about 10 ft. below the quarry floor, driven by a vertical motor made by the Ideal Motor Co.

"The No. 30 crusher discharges over a stationary bar grizzly, the finished product passing through and rolling down the hill, while the oversize passes into a No. 49 Kennedy gearless crusher, and this in turn discharges over a bar grizzly; again the through



New plant of the Zenith Limestone Co., of Tulsa, Okla.



Another view of the side-hill plant of the Zenith Limestone Co.

material, rolling down the hill to meet what has passed through the upper grizzly, while the oversize from this crusher again passes to a No. 37 Kennedy gearless finishing crusher, and the discharge of the latter crusher meets what has been finished by the other machines, and all this rolls into a small bin holding about 40 tons.

"It was originally intended that the finished stone should roll by gravity into the screens, but as I mentioned above, a conveyor became necessary and this conveyor is under the bin which contains three self-opening bin gates, and when these are open, the stone flows gently onto the conveyor belt and is carried to the screens.

"The screen bin is of crib formation, and two 60-in. by 24-ft. Kennedy screens are installed here, each having a 7-ft. dust jacket. These screens are ample for screening and sorting the present intended output, but the plant is so designed that without much trouble another screen of the same size can be adde, and by the addition of another No. 37 finishing crusher, which has also been provided for, the plant will then be capable of producing 3000 tons per day.

"There are two tracks running under the bin, which is to have a capacity of about 2000 tons, and under this bin are 28 self-closing bin gates which enable the operator to load the cars quickly. They have an immense amount of trackage and can spot 50 empty cars, and also enough room on the other end of the bin to store 50 loaded cars.

"There is no tailing chute, as there are no tailings, from the fact that the No. 37 crusher is designed to finish the stone to the proper size.

"The screens are driven by direct-connected motors with flexible couplings, and this seems to me a very good idea as, if anything happens to one screen, it can be stopped and the material passed to the other screen, thus preventing the closing down of the plant for a little repair.

"Around the top of each crusher Mr. Long has built a 4-in. plank floor with steps, as you will notice in the pictures, and a complete double railing of 3-in. pipe surrounding each platform, and standing at the bottom it looks like anything but a normal crushing plant. In fact, the first time I saw it, it reminded me of the upper decks of a large battleship.

"There will be surprisingly few men employed at this plant, as the whole crushing and screening system is designed to be automatic, and the cost of production per ton, when this plant is running at full blast, will be reduced to a minimum.

"The property is situated about four miles west of the city of Tulsa and on the south bank of the Arkansas river. They have a vast amount of property, but the area of the limestone on top of the hill is something like two miles in length and 2000 ft. wide. There are no clay or dirt seams and this makes it so that after the face has been fully developed their operations will be simple and not costly."

Slate in 1924

REPORTS of slate production in 1924 cover both of the big producing centers of the East—the Bangor section of Pennsylvania and the Granville section of New York and Vermont. In both cases production was about the same as in 1923, but apparently there was more prosperity in Pennsylvania than in New York and Vermont. In both instances more production is expected in 1925.

There is no prospect of lower wages or lower prices. The run-away labor market has been checked, however, and strikes have been broken. For a time it looked as though the roofing slate industry would go out of existence because of the strangle hold of union labor, which increased wages and cut off the normal supply of apprentices beyond all reason; but the struggle ended as all such attempts to circumvent economic laws always end—in the loss of business to producers and the loss of wages to slate workers. At the end of the season there was a surplus of labor in both slate-producing sections.

Under the circumstances slate producers cannot be expected to be very keen for enlarging their present plants. They are, however, more ready than ever to invest in labor-saving devices, if successful devices can be worked out.

New Florida Rock Crushing Plant Begun

CONSTRUCTION of a rock crushing plant for the manufacture of stone to be used as road material will be started near Brooksville, Hernando county, Fla., in the near future, according to announcement by a representative of C. & J. Camp, of Ocala.

The new plant will have a daily minimum capacity of 1,000 tons. It will be in operation within two months.

Materials for this feature of road work are now imported to Florida from Alabama, Georgia and South Carolina. Decision to build the plant at Brooksville followed discovery of large stone deposits there, which are said to be enough to supply much of the demand in this state.

The plant will be operated by electricity, supplied by the Florida Power company, another of the Camp interests. The Camp concern has been doing business in this state for years as a phosphate mining corporation. Both members of the firm are residents of Ocala.—*Tampa (Fla.) Times.*

Production of Mineral Colors

A PROMINENT producer of mineral colors in the South reports that both production and demand increased during 1924, and that prices were steady and the margin of profit somewhat less than 1923. He looks for 1925 to have about the same production and demand, with prices practically stationary with perhaps a trifle less margin of profit. There is no prospect of lower wages or lower prices; in fact, wages in this section (the South) may very possibly increase.

There have been a number of new enterprises of this character and with the increasing use of colored concrete products and stucco this producer believes that the demand will show a healthful growth. Nevertheless, it is easy to expand too rapidly in the production of a commodity of such a limited demand. This producer is sure that production can be materially increased by existing plants and with a corresponding reduction in cost.

Increased Use of Magnesite

JUDGING from reports reaching us, the magnesite industry improved considerably over 1923 conditions—probably showing an increase in production of from 15 to 20%. An increase of approximately 20% is looked for in 1924.

No increases in wages or prices are looked for and all indications point to about the same conditions as in 1924.

This industry, like the gypsum industry, makes use of research men and new products are in the process of development. One of these new building products is a kind of outside wall board or sheathing, another is an interior wall plaster.

Alabama Asphalt Lands Being Bought

CONSIDERABLE activity is occasioned by prospective asphalt developments near Hazelton, Ala. Leases are being obtained on many tracts of asphalt bearing lands with a view of future development. The local product has been used on a stretch of local road and is said to be holding up well. This is expected to encourage development of local deposits on a large scale in the near future.

It is said that almost an unlimited supply of asphalt bearing rock exists in this vicinity.—*Birmingham (Ala.) News.*

New California Crushing Plant Begins Production

REPRESENTING a total investment of approximately $100,000, the rock-crushing plant of the Verdugo quarries near Montrose, Calif., was completed recently. The Verdugo Quarries, owned and operated by Schweitzer Brothers, is one of the largest 100% gravity plants in the entire West, according to Victor H. Martin, an official of the concern.

The completed plant consists of four bunkers, storage bins and a blacksmith shop, located on the 910-acre holdings of the concern. The acreage is covered with black granite, gray granite, limestone and silica. The capacity of the rock-crushing plant is from 800 to 1000 tons every eight hours.—*Los Angeles Times.*

The Gypsum Industry in 1924

Tremendous Progress in Gypsum Products and Remarkable Increase in the Capacity of Wall-Board Machines

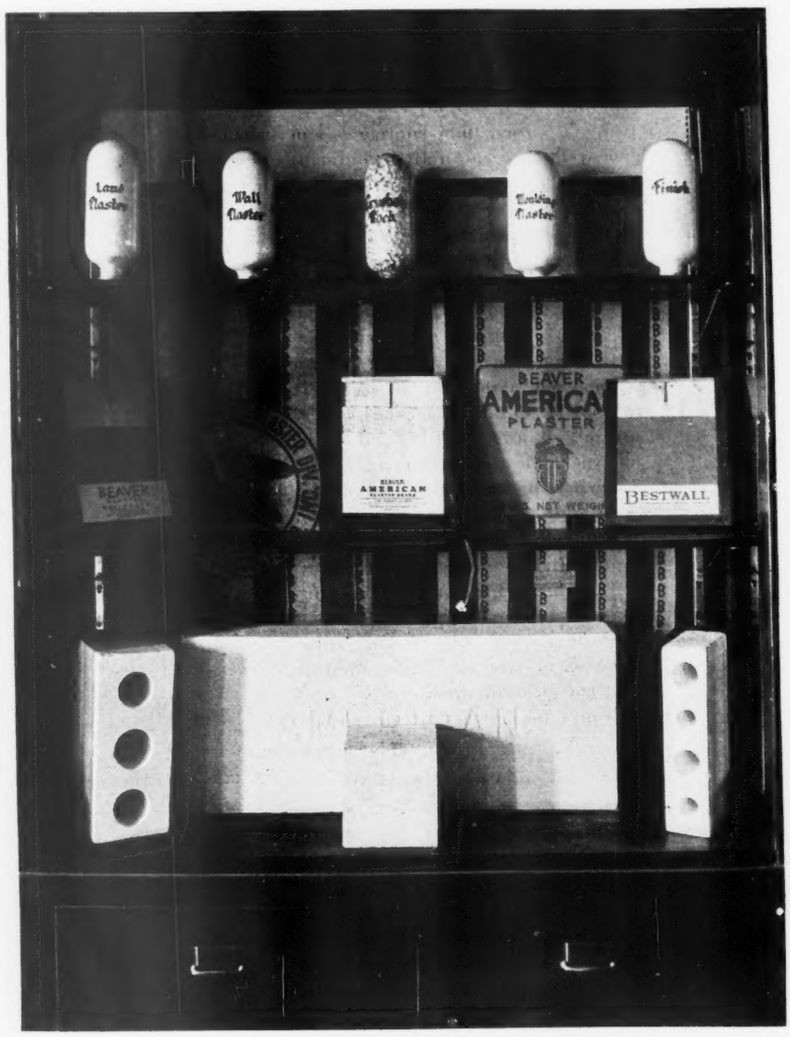
THE gypsum industry made some remarkable strides in 1924 and perhaps none of the rock products industries shows greater possibilities for the future. This year has seen the introduction of two kinds of continuous, practically automatic, block- and tile-making machines and the perfection and installation of some truly remarkable wall-board machines.

One of the block machines was described in the article on the Ebsary Gypsum Co. plant (Rock Products, March 22, 1924) and the other in the issue of February 9. The important development in the wall-board industry has been the perfection of an automatic wall-board drying machine which has doubled and tripled the capacity of wall-board plants.

The United States Gypsum Co. pioneered in this field, but other manufacturers have kept up the pace, and the wall-board plants of the American Gypsum Co., Gypsum, Ohio, described in Rock Products, August 23, 1924, and of the American Cement Plaster Division of the Beaver Board Co. in this issue are excellent examples of the truly startling progress made in gypsum wall-board manufacture.

Nor has the development of special products ended with the perfection of gypsum block and wall-board manufacture; the United States Gypsum Co. announced in Rock Products of December 13 an entirely new product which is mixed with aggregates to form a concrete exactly as portland cement is used. Because of quick-setting qualities and light weight this new gypsum product "Structolite" is expected to find a large field in dwelling-house and small commercial building construction, as well as for partition walls in skyscrapers.

One of the best informed men in the industry tells us there is great activity in the development of other special products; and men in this industry feel that only a beginning has been made in the development of new uses for gypsum and new gypsum products. More than any of the other rock products industries, the gypsum industry welcomes and uses the services of high grade research men in the development of commercial products.



Example of modern gypsum products

In comparing the progress made by the gypsum industry with that of other rock products industries it is well to bear in mind that there are some fundamental differences which have favored the great activity in the development of new gypsum products. Probably over 75% of gypsum production of the country is in the hands of three, or at most four, manufacturers. Each is able to maintain its own research organization and its own national distribution organization. They are big national advertisers. They are keen competitors for prestige.

While co-operative research through trade associations is a most desirable and perhaps essential factor in modern industry, it does not and can not take the place of individual company research. The same incentive for direct gain and supremacy is lacking. The experience of the gypsum manufacturers is interesting and illuminating.

In the matter of production during 1924 present indications are that gypsum shared in the general increase of business as much as or more than the other major rock products. Prices were various. We are informed that calcined gypsum for plaster sold as low as $3.50 per ton in some few localities during the year. It is evident that the larger companies are taking their profit more and more in specialties and that the tendency will continue in that direction.

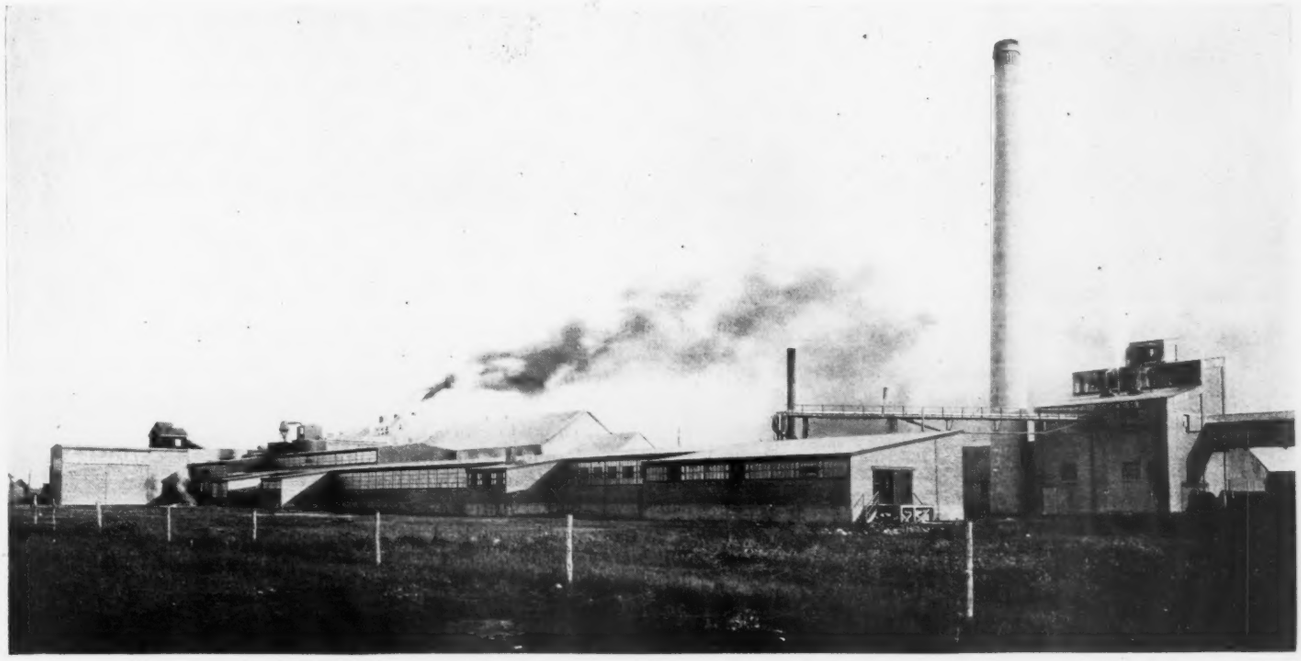
The amount of crude gypsum produced in 1921 was 2,891,000 tons; in 1922 it was 3,780,000 tons; in 1923 approximately 4,753,000 tons. The percentage of increase during these two years was nearly 50% and 33⅓%, respectively. We venture the prediction that 1924 saw at least a 25% increase over 1923 production—making the percentage of increase in gypsum production more than the percentage of increase in any other rock product. The biggest increases in gypsum products production have been in wall-board, the 1923 production of which exceeded the 1922 production by 64%. We believe the 1924 production of wall-board will show 50% increase over 1923. This forms an interesting commentary on the age-old contest for the wall plaster business.

Latest in Gypsum Wall-Board Plants

Beaver Products Company Ft. Dodge Plant

By Charles A. Breskin

THE new Ft. Dodge, Iowa, wall board plant of the American Cement Plaster Division of the Beaver Products Co. of Buffalo, N. Y., is an excellent example of the progress that has been made in the manufacture of gypsum products in 1924. It will be described in detail in a forthcoming issue, this being merely an abstract of such a description emphasizing some of the more unusual features.



General view of the entire plant of American Cement Plaster Division, Beaver Products Co., Inc., at Fort Dodge, Iowa. The wall-board plant and new power house are in the foreground

The plant is situated about three miles south of Ft. Dodge, Iowa and has now been in operation for four months. Its rated capacity is 150,000 sq. ft. of wall board in 24 hr. although this rate of production has been exceeded. It is run in connection with the company's own mine and plaster mill, the stucco being carried from the mill to the wall board plant by a screw conveyor.

From the mine an Ottumwa electric hoist lifts the loaded cars 70 ft. to the hopper of a Fairbanks dial scale. Then it is dumped to the crusher hopper and thence is fed to the rotary primary crusher. An interesting system of conveyors, one of which running underground is 870 ft. long, carries the rock, reduced to sizes between 1½ in. and 3½ in. to the dryer. Before it reaches the dryer it is sent over a Dings Magnetic pulley to remove tramp iron.

The dried rock goes to a Jeffrey hammer mill which crushes everything to ½ in. size. Thence it goes to Hum-mer screens which make three products. Some of the rock is shipped to portland cement manufacturers and another part is sold for land plaster, but the largest portion of it goes to the roller type grinding mills.

The ground product is separated in Emerick air separators which return the oversize to the mills and send the fine product to the bins above the calcining kettles. There are three of these, made by the J. B. Ehrsam Co., each equipped with Tyco indicating and recording thermometers.

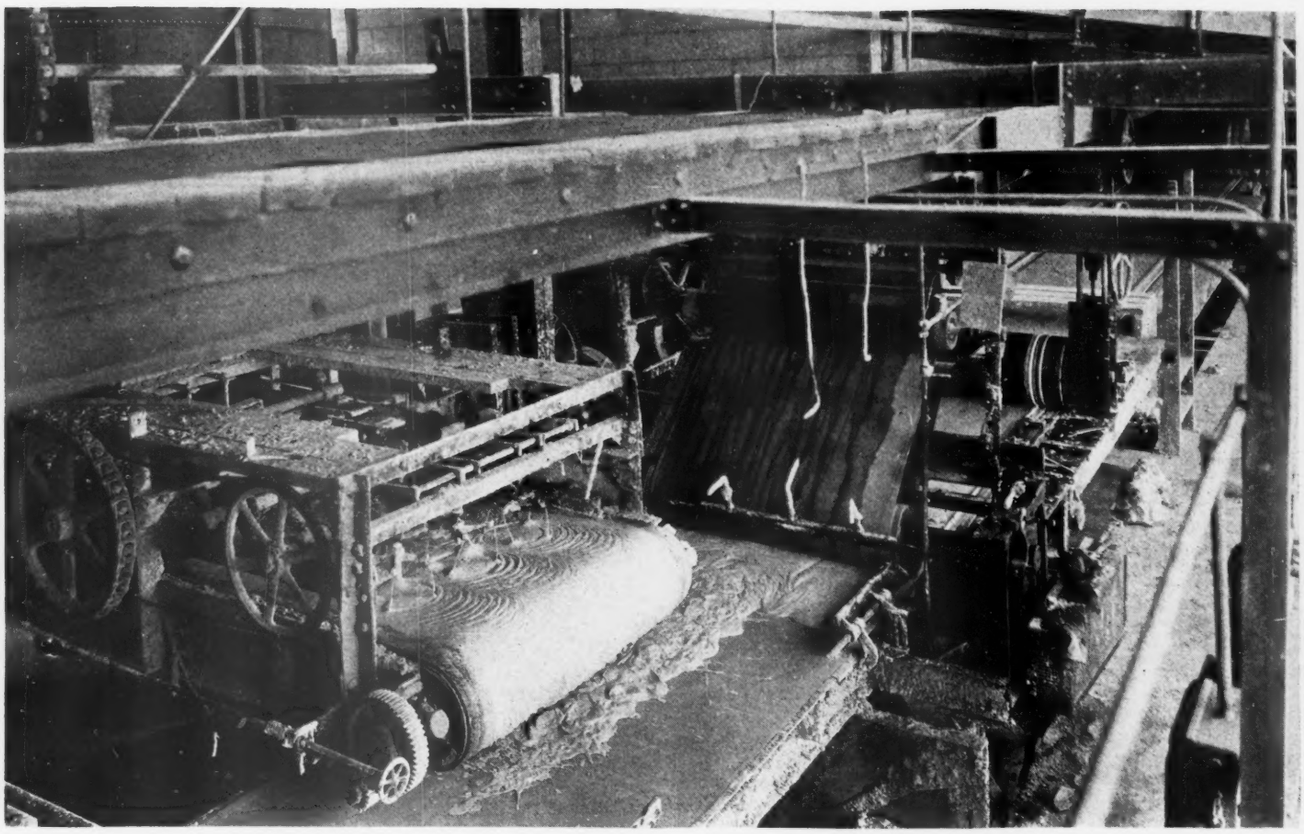
The stucco is elevated from the hot pits to either the plaster mill, block mill or wall board plant, as desired. At the plaster mill are two Broughton mixers and open-mouth packers and a 3-valve Bates packer by which the various plasters are mixed and packed for shipment.

Stucco for the wall board plant goes by a screw conveyor to a bin from which it is taken to the mixing belt by a chain drag. A similar drag brings in the sawdust from its bin. Accelerator is added to the stucco from a small hopper.

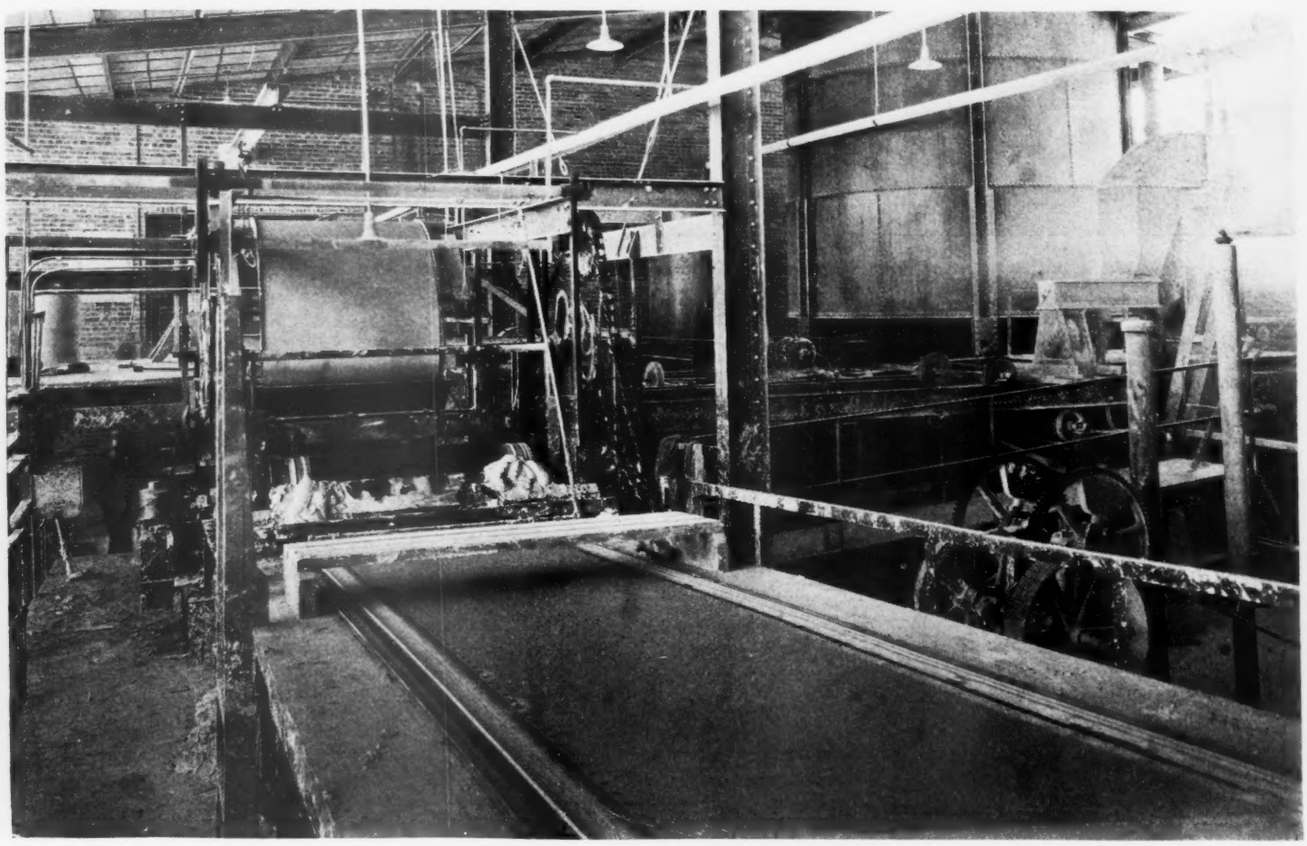
The mixing belt is a 53-in. Goodyear belt running in a water bath. Ten agitators like egg beaters work just above the belt and thoroughly mix the materials before they are fed on the feed belt of the machine.

The paper on which the mixture is spread, and with which it is backed, comes from the company's own mill in Canada. There is an ingenious arrangement by which fresh rolls may be put on without stopping production.

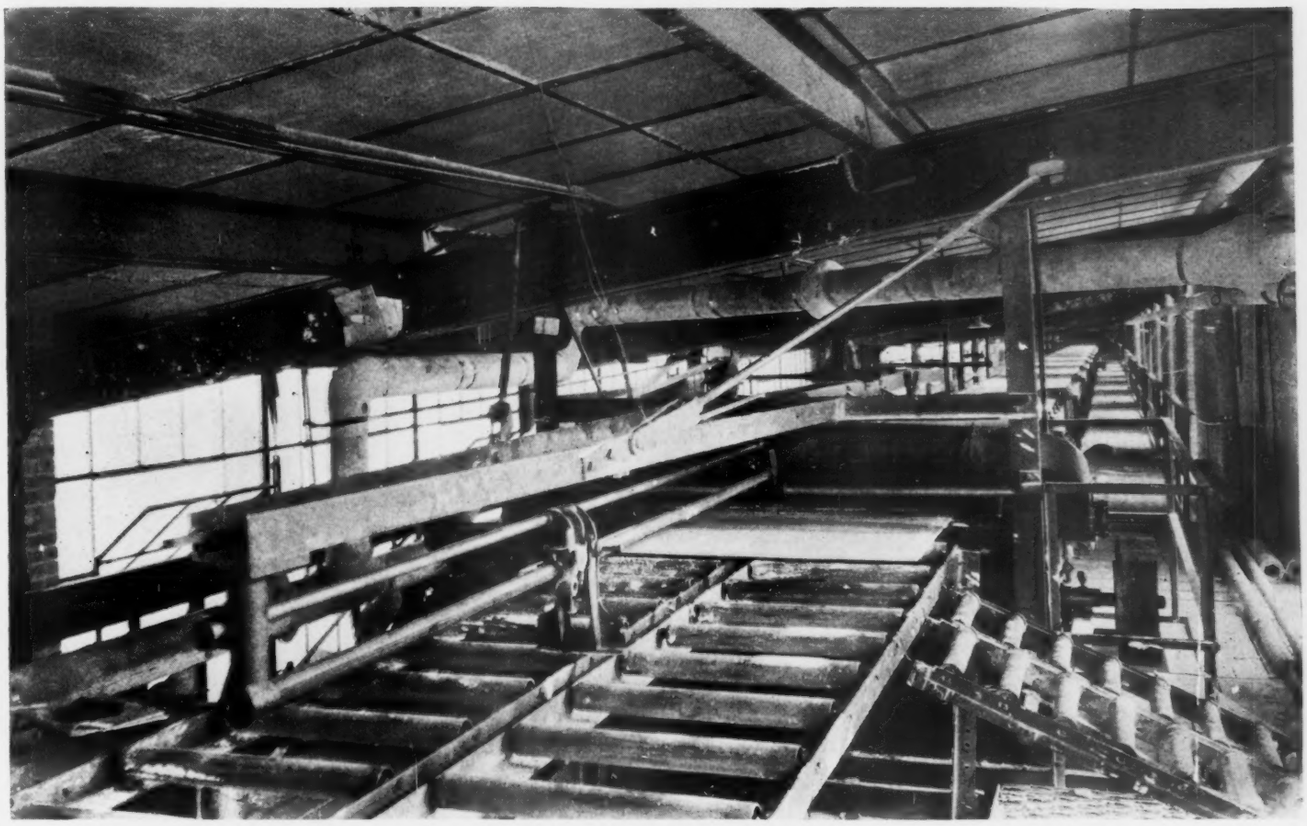
After passing the squeezing and ironing rolls the "green" board goes to the cut off saw and then is pushed on to the transfer and hydraulic elevator. These two machines make up one of the most interesting features in the plant and are more fully described in the detailed description that will be published a little later. The transfer is an ingenious system of rolls and the elevator places the boards two abreast on the decks of the



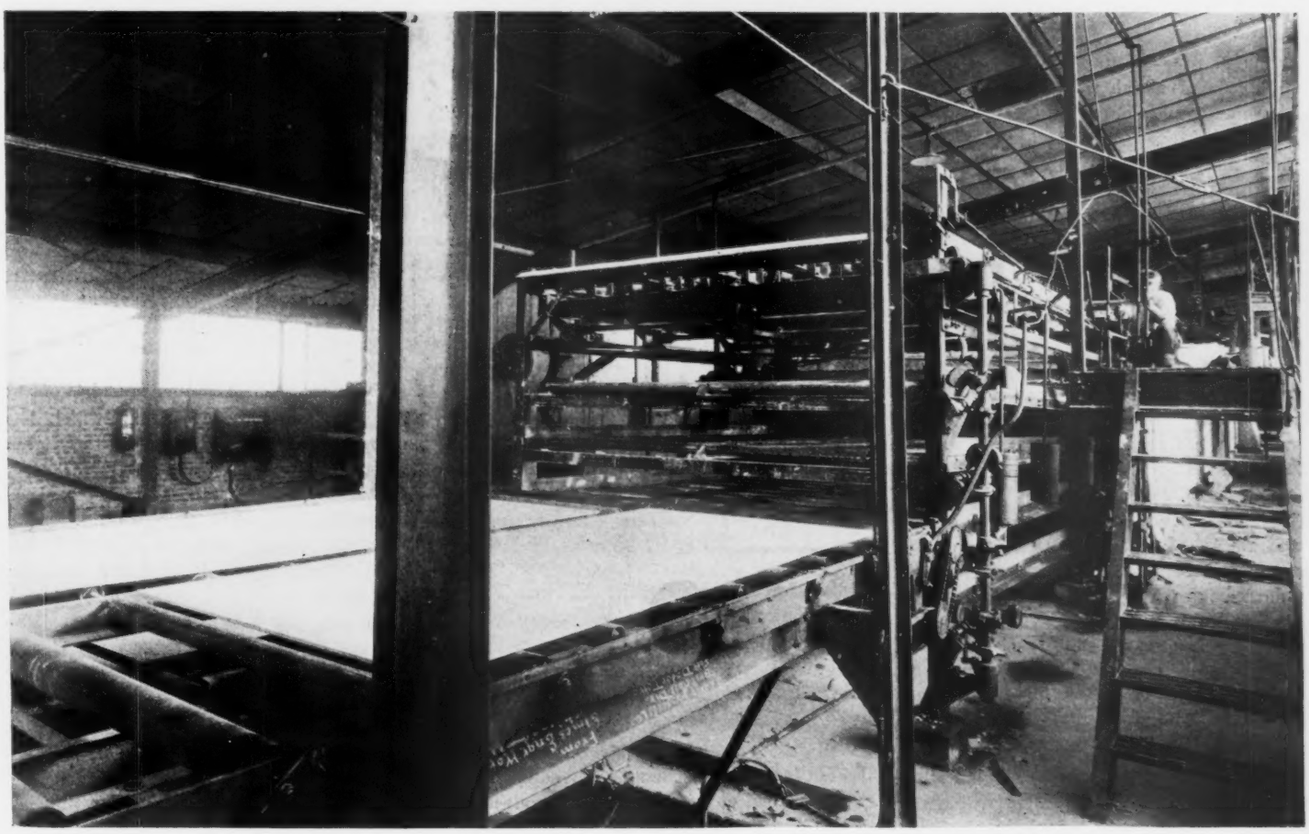
Discharge from mixing belt onto face paper of board. Note egg-shaped agitators at discharge end. The mixture is just coming to the squeeze roll where it meets the face paper. After leaving roll, the edges are turned over and the "green" board is on its way to the ironing rolls. Note "distributor" at feed roll and precautions taken to safeguard men from hazardous machinery



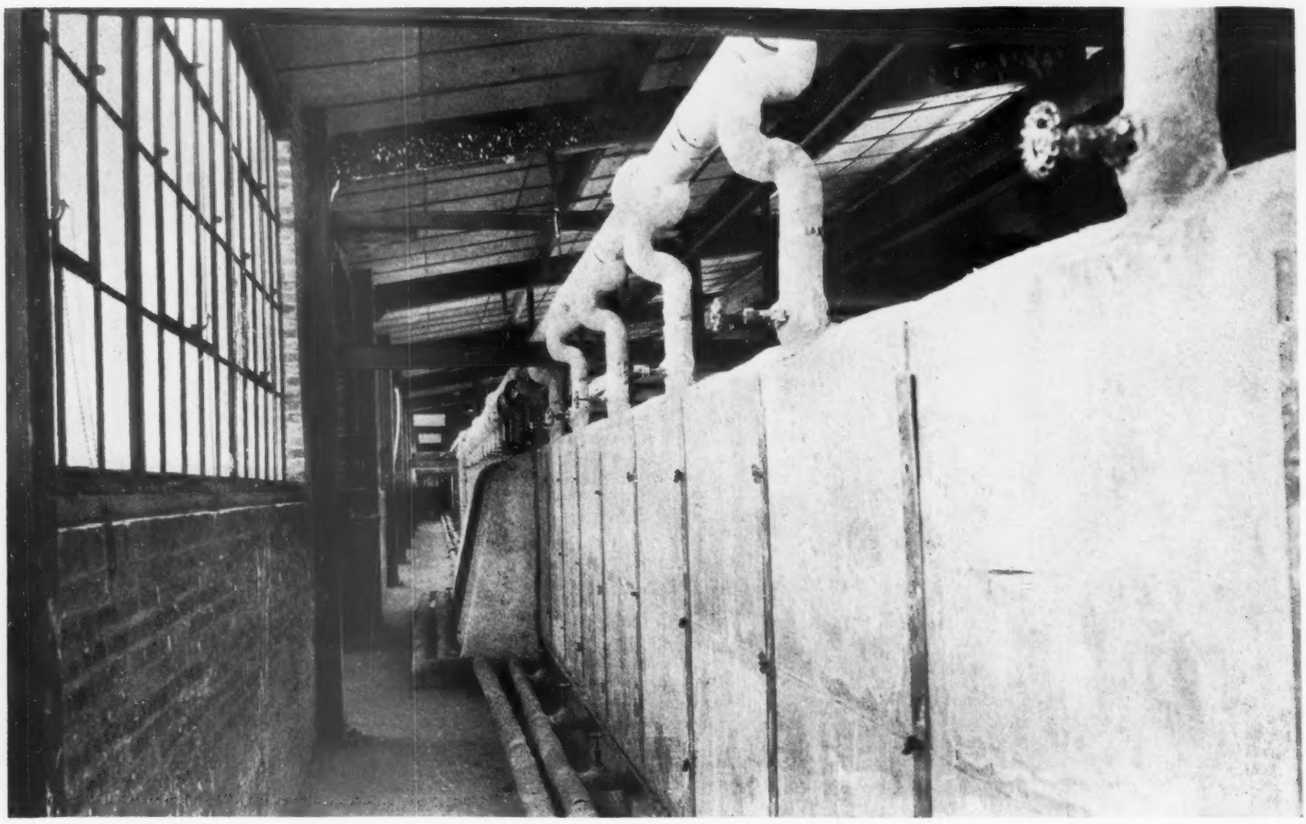
The "green" board, edges turned over, on its way to the ironing rolls. The roll and knife in foreground scrape off excess plaster from board. In the background is the sawdust bin and the mixing belt



The board has now reached its initial set and has approached the cut-off saw. As soon as the end strikes the stop, shown in the foreground, the board is cut and rolled to the transfer table. Underneath the conveyor, shown here, is located the dryer



The transfer, hydraulic elevator, and entrance to dryer. In this view the board is shown entering third deck of dryer. Note dogs, or cams, for regulating stop of elevator on side of entrance to dryer. One operator does all the work



View of the dryer itself. It is 270 ft. long and has a 50-ft. cooling section. The ducts shown in the center by-pass air from the supply fans to a passage underneath the dryer returning to the blower. Note how well dryer is insulated

dryer, as desired. The hydraulic equipment was made by Chas. F. Elms Co. of Chicago.

The dryer which was made by the Coe Manufacturing Co. of Painesville, Ohio, is another of the unusual features of this plant and was designed especially for it. In the forthcoming detailed description its construction and operation will be given in full but here it can only be mentioned that while it was designed to evaporate 8/10 lb. water per sq. ft. of board, it has been found to have a greater capacity. The steam used in the banks of coils of this dryer is automatically returned (as condensate) from a tank provided with an S-C regulator and relief valve. Tyco recording thermometers are installed on each section of the dryer.

The air circulating system, which is of the latest design of the Coe Manufacturing Co., has two Bayley fans that force 50,000 cu. ft. per min. of air through the coils. One fan is at the wet end and one at the dry. The air is returned to the fans except for about 15 per cent which is removed by a Bayley exhaust fan, this loss being made up at the blowers. This constant removal of part of the air keeps the circulating air from becoming saturated.

The dried boards are removed on pallets and handled by a 5-ton Northern electric traveling crane with specially designed cradle.

Two American deep well pumps furnish water for the plant, which is treated in a Scaife "We-Fu-Go" water softening system.

At the power plant the water for the boilers is pumped by a 4-in. Terry centrifugal pump to two B & W standard water tube boilers, each of 300 hp. These are equipped with LaClede-Christy chain grate stokers.

The board plant is wholly electric driven, Westinghouse motors being used throughout. Elevators and conveyors are Link Belt and drag chains and transmissions were furnished by the Dodge Co. Belting is all Goodyear and all conveyor idlers and rolls are of Caldwell make.

Still Hounding Manufacturers of Portland Cement

NEWSPAPER reports, including dispatches from Washington correspondents, have said that the Federal Trade Commission was about to take action against the cement companies of the country for forming a conspiracy to maintain prices. This is denied by the *Wall Street News*, which says:

Attorney-General Stone has denied that the Federal Trade Commission had sent to the Department of Justice data against an alleged combination of producers of cement who were said to have formed a conspiracy to maintain prices.

The Federal Trade Commission, however, it was learned, has received complaint that the continued high price of cement is through associations of which cement producers are reported to be members. It was not said whether the Federal Trade Commission is conducting an inquiry into the matter.

Bessemer Limestone and Cement Company Resumes Payment of Dividends

THE Bessemer Limestone and Cement Co., of Youngstown, Ohio, which has resumed common dividend payments after a 4-year lapse, will ship about 1,250,000 bbls. of cement this year, an increase of 50,000 bbls. over last year. In 1924 flux stone shipments, though, owing to decreased blast furnace operations, will be lower than the past year.

The company has had two exceptionally good years during which it is understood to have added heavily to its surplus. Building of a cement plant in 1920 in connection with the depression obliged it to offer $750,000 of notes which have been about half retired. They are convertible into common. Bessemer has $1,480,000 of common and $1,000,000 preferred in addition to notes outstanding. Common was restored to a 6% annual basis.—*Wall Street (N. Y.) News.*

Review of Phosphate Rock in 1924

Not Much Increase in Production but Great Technical Progress

By James A. Barr
International Agricultural Corporation, Mt. Pleasant, Tennessee

THE first part of 1924 the majority of the mines in Tennessee were shut down or running at part capacity. Operations were later hindered somewhat by an unusually dry spell that lasted from June to November.

Recently shipments have picked up and at least two companies have started running mines at capacity, leaving only two active mines shut down in the field, out of a total of nine that have been kept in operating condition.

No new construction of importance was undertaken during the year. The Ashwood plant of the Ridley Phosphate Co., started late in 1923, has been completed, and the local officials report that operations will be commenced as soon as the storage lake supplying the washer has been filled by fall rains. This washer was described in the September 20 issue.

Seeking New Heat Methods for Making Phosphoric Acid

Hoover and Mason and the International Agricultural Corp., Mount Pleasant, Tenn., have been active in research work along lines of utilizing lower grades of phosphate rock and the methods of producing phosphoric acid. The former company has been investigating heat processes for the production of phosphoric acid direct from phosphate rock and mine run phosphate, and it is said that the results are encouraging.

The International Agricultural Corp. has completed an extended investigation of sintering and briquetting in which they were able to produce carbon bearing and plain briquetts not only from run of mine phosphates but from higher grade washed products. Briquetting will be of considerable importance in any extended use of heat or furnace methods, such as might be applied at Muscle Shoals, as the available supply of lump phosphate is limited and consumed by present trade requirements. The supply of "lump" cannot be materially increased without a prohibitive rise in price.

In July, the International Agricultural Corp. built a pilot plant for the production of poultry grit, and have recently put the product on the market with success. A certain layer of the Bigby phosphatic limestone is used, which is uncovered in regular mining operations. The following is a typical analysis:

	Per cent
Calcium carbonate	72.0
Tricalcium phosphate	22.0
Iron, magnesia, etc.	6.0

The run of mine lump is crushed in a 24x20-in. Jeffrey pulverizer and separated into five sizes by a double bank of specially reconstructed Newaygo screens, making a return oversize to crusher, three sizes of grits, and a minus 22-mesh agricultural size.

The Rockdale Iron Works at Rockdale, Tenn., manufacturers of ferro-phosphorous, are preparing to double their capacity by installing larger and improved machinery and a new 12x90 ft. blast furnace in the place of their present 8x40 ft. stack. The increased output will be obtained with practically the same amount of labor as that used in their present operations.

The Federal Phosphorous Co. at Anniston, Ala., has been actively engaged in research work on both electric furnace and blast furnace methods, to lower the production cost of phosphoric acid, as a result of their bid for Muscle Shoals power. The problem to be solved is the effective recovery of waste heat, since the sum total of the heat reactions is exothermic. The main cost of electric furnace production of phosphoric acid is for electric current, which is becoming increasingly valuable for power purposes.

No new methods have been developed or used in the mining or preparation of phosphates in the regular washing and drying plants. The removal of overburden is now practically all done by steam draglines and the mining about equally divided between dragline and hand work. While hand mining is more expensive, still because many deposits contain "cutters" (narrow channels between limestone boulders) which are too small to admit of mechanical methods, hand methods are still employed.

Washing Methods

In the washing department all companies use the same general principles of stirring to elutriate or float off the clay, the main difference being that some crush by rolls to about ½ in. before washing and others let the lumps go through at full size. The latter claim less loss in the fines, which must result from any crushing operation. Hydraulic or jet washers are practically standard for washing the fine sand left after screening out the rock, dewatering being done in Allen cones or hand operated cones or Dorr classifiers. Dorr thickeners are mostly used to recover the finest material, ranging between 60- and 200-mesh.

Cheaper power is very much needed in the Tennessee phosphate field and the surplus from Muscle Shoals could be used to advantage.

In the Florida Field

As in Tennessee, production lagged in Florida during the first half of the year and then increased until it now looks as if the total for the year may equal the 1923 tonnage.

When the U. S. Shipping Board increased the rates to foreign ports, the export trade was almost paralyzed, due to severe competition from African sources. Later on in the season rates were reduced and this resulted in an immediate revival of foreign shipments.

Very little construction work has been done in Florida during the year until the last two months, and then mainly in the way of replacements or removals and not to increase capacity.

However, the Phosphate Mining Co. has departed from the standard methods of wood construction and has built a steel washer near Mulberry. Electric vibrating screens will be used in place of the usual rotary screens. The function of the Florida pebble washer is to elutriate the clay, which is done by log washers, and then to screen out the silica, limiting the recovery to 1 mm. size and coarser products. All the fine phosphate granules and the clay-like soft phosphate pass through the 1 mm. screen and are lost.

The International Agricultural Corp. is drawing up plans for a new washer with alternate designs, which are being considered, for both wood and steel. Aside from the usual log washers and stationary flat screens, the novel features will be the exclusive use of electric vibrating screens and the crushing of all pebble over ½ in in rolls. The crushed material will be put back into the washer in closed circuit.

The use of electrically vibrated screens is being extended on account of the lower cost of upkeep as compared with rotary screens, the use of less power and higher efficiency with a smaller screening surface. Extended tests have shown the screening efficiency, using millimeter opening "Toncap" screen, to be better than 99·5%. The recovery is

higher than for a rotary screen since it is possible to use a smaller mesh without blinding, and at the same time remove the silica grains efficiently.

The Southern Phosphate Co. has mined out its tract of land at Medulla and is constructing a new washer at Paulway. All equipment is now being moved to that point. This company uses an a.c. rheostatic-control electric dragline, with 150 ft. boom and 5 yd. bucket for removal of overburden. The operation has been very successful in reducing stripping costs below those usually obtained by hydraulic methods.

Swift and Co. have mined out their Alafia tract and are moving all their equipment and rebuilding at Tiger Bay. Steam draglines, mounting 125 ft. booms, are used for stripping overburden.

Dragline Stripping

The increased use of dragline excavators, replacing hydraulic methods for the removal of overburden, deserves special mention. Where a loose overburden is handled that washes well under moderate water pressure directed from a monitor, hydraulic methods might sometimes be employed as cheaply as draglines. Other conditions necessary are cheap power, ample water supply, nearby debris disposal pounds, deep overburden and the use of large pumping outfits. These conditions are found only in isolated cases. More often it is found that the overburden does not disintegrate readily, so that 200 lb. nozzle pressure must be used and very often hardpan is encountered that requires much blasting and mud capping of lumps. Where the underlying phosphate strata is soft, a considerable quantity is lost in ditches from the face to the pump sump. A considerable number of palmetto roots and stumps are left which require extra labor for removal before mining operations start, and all these conditions tend to give the dragline the preference.

The latest installation of draglines has been made by the International Agricultural Corp. Two direct-current, Ward Leonard control draglines are now at work and are giving good results. These machines mount 125-ft. booms with 4-yd. buckets. A third steam machine, with 125-ft. boom and 3-yd. bucket, was also installed, operating under conditions similar to those encountered by the electric draglines, thus allowing comparisons to be made between the two types. The results are entirely in favor of the electric draglines.

Draglines Compared

Here, as in other fields, there is an unsettled controversy as to the relative merits of rheostatic alternating-current machines and the direct-current type. The alternating-current machines are cheaper in first cost and simpler in electrical construction. The direct-current machines have a graduated motor action more like steam, appear to be easier on cables and cause less fluctuation of demand current. The latter is quite important for a company where the machine will be served by a small power plant or where the dragline load is large as compared with the total load and the demand charge for current is a factor in the total cost of electricity.

The superiority of the electric machine, where current is available at reasonable rates, may be summed up as having approximately 20% greater operating time due to less shut downs for repairs, coaling, and supplying water. Less labor is required and for single shifts or intermittent work and no night watchman is needed to get up steam.

In the mining of the pebble phosphate no radical changes or improvements have been made. Visiting engineers often wonder why the arguments in favor of dragline stripping do not apply to mining. In mining other conditions interefere, such as the washing action effected by the hydraulic operation, with attendant simplification of the washer, the rather soft character of the phosphate matrix, and the avoidance of expensive track and rolling stock upkeep, such as would be required where operations are being constantly shifted. A close analysis of comparative costs has been found to justify present hydraulic methods.

The trend towards larger hydraulic units continues, though some maintain that the present 12 in. unit is sufficient on account of the increased difficulties of handling larger pipes and pumps. However, the American Cyanamide Co. will install a 14-in. mine pump.

New Movable Washer

One company will try out a new scheme of a movable intermediate washer to be located close to the mine face in the pit. It will consist of a rotary washer of the nature of a tube mill without a ball charge, mounted on a standard dragline excavator caterpillar base. The idea is to remove a large portion of the clay in the pit, pumping the balance of the matrix to the regular washing plant for the final separation of silica and clay. Should the idea not prove feasible, the caterpillar base will be used for a regular dragline, to be employed in stripping and ditching.

All the Florida companies are very keen in trying out any new labor saving device and for this reason the winch-type caterpillar tractor has been tried and proven successful as compared to hand methods in moving heavy pump cars and pipe over the muddy irregular pit bottoms. Like the tanks employed in the world war it will go almost anywhere and possesses remarkable power.

In the washing department considerable attention is being given to possible increase of recovery, since the present losses are high. The difficulty lies in the fact that in the minus 1 mm. size, the silica grains are practically the same size and specific gravity as the phosphate and also that soft phosphate forms a coilloidal solution along with the clay. One idea at present is to save all granular material by jet washers and classifiers or dewaterers and to store it against the day when lower grades will be used and where it can be made cheaply and quickly available; another being to effect a separation by chemical methods such as the use of sulphuric acid, as a solvent in a Dorr counter current system, producing phosphoric acid. No means have been discovered to recover the soft phosphate, the only method that has been suggested being the use of the run of mine matrix as briquetts, in a heat furnace to recover the phosphoric acid by volitalization.

Electric Furnace Tried

The American Cyanamide Co., recently completed a series of elaborate experiments with a full size electric shaft furnace using briquetted run of mine phosphate. The equipment is being dismantled and no data is available. It would seem that the cost of power from steam stations would militate against the success of this project in Florida.

The scarcity of sand and gravel in this section of Florida has resulted in one company entering the sand and gravel business. It prepares the debris which has accummulated from its regular phosphate washing operations and turns out concrete and plaster sand. Low grade phosphate pebbles from 1¼ to ⅜ in. are also being used for concrete aggregate.

Drying operations are also being investigated, since most companies are not satisfied with the over-all heat efficiencies of the present dryers. While most of the standard equipment is fairly efficient as phosphate is quite difficult to dry, owing to the entrained as well as the surface moisture, still there is room for improvement. For example steam atomizing oil burners are largely used, thus introducing steam into a atmosphere that is already saturated with moisture, which is a detriment to drying conditions. Mechanical oil burners will be tried. There is considerable heat loss in the stack gases but as they are already saturated they cannot be used to advantage in preliminary tower dryers. The use of the newly developed air heaters used in modern power plants has been suggested but their trial would necessitate expensive installations.

Competition has been so keen and selling prices so low that the companies have spared no thought or expense toward effecting economies, all of which furnish excellent food for thought to the fair minded citizen, especially the farmer, who is being continually fed up with unfair propaganda about the fertilizer trusts and almost free Muscle Shoals fertilizer.

Year of Progress for Sand-Lime Brick

Conditions Reported Favorable for 1925—New Process Developed

By Charles A. Breskin

IN general the year 1924 was a fairly prosperous one for the sand-lime brick industry. Most plants report a greater production than that of the previous year, although in some localities prices dropped below one which would give a fair profit. One of the outstanding features is the growing appreciation on the part of architects and contractors for sand-lime brick as a quality product. As the new year approaches, conditions become even more favorable and the outlook for 1925 is exceedingly good.

Due to increased costs of labor, fuel and other commodities entering into the manufacture of sand-lime brick, considerable improvement has been brought about in the actual manufacturing process. This has enabled producers not only to meet clay brick competition but actually to turn out a better product. The advent of automatic proportioning machines for measuring sand and lime in connection with rod mills for grinding and mixing of raw materials are responsible for many economies. Of course, refinements in hydration of lime and the actual mechanical handling of the raw and finished product have been great aids, eliminating much of the manual labor in plants.

Milwaukee Brick Makers Report a Good Year

The Acme Brick Co., representative of the Milwaukee, Wis., district reports "the production and sale of sand-lime brick higher than any previous year at their plant. Also, that all producers of sand-lime products in that vicinity have enjoyed a good year, many of them setting new high marks in their production and sales."

H. H. Gould, Belt Line Brick Co., Minneapolis, Minn., writes: "This year building material conditions in our territory have been extremely abnormal with prices very much in favor of the buyer.

"Our sand-lime brick plant at New Brighton has been in constant operation since we started up early last spring, and we intend to operate until the last of this month (December) which is our usual time of closing. This is not a very bad record in consideration of operations and conditions as they have existed this year."

"I believe you will find that other sand-lime brick plants in this territory will bear me out in my statement that the alleged 'synthetic brick' or substitute for brick as sand-lime brick has been styled from time to time by unscrupulous competitors is rapidly coming to the front.

"We recently solicited comment both favorable and otherwise from constant users of sand-lime brick, and our reports are exceptionally gratifying. Lime and cement dealers who handle our brick in the Twin Cities in connection with their solicitation of building materials for residence work chiefly are using 90 per cent sand-lime brick as against common clay and about 15 years ago they all used clay brick. There is nothing to disguise here, because clay brick and sand-lime brick are available at practically the same price, but the contractors seem to prefer sand-lime brick up this way.

"A few years ago most of the architects here were skeptical with reference to the use of the sand-lime brick as compared to clay brick and that of course was quite natural with something new. In other words I believe we all are inclined to be rather slow to deviate from the beaten paths of routine and it was quite the custom in writing specifications to merely name common clay brick, but some of our leading architects specify sand-lime brick up this way without alternate.

Used Any Place Where Brick Is Called For

"'Belt-Line' sand-lime brick is used any place where common clay brick is called for. The absorption test is low and the compression test far beyond what could be expected. The building department of Minneapolis is a particularly technical outfit and they permit the use of our brick for load-bearing walls and we have them in some of the largest buildings in Minneapolis, even our so-called skyscrapers."

From W. K. Squier, Paragon Plaster Co., Syracuse, N. Y., comes the following:

"Our plant is small and not equipped with up-to-date appliances. Our output is just normal this year and the demand for common brick in Syracuse has not been good this year. The clay brick manufacturers complain but we have more than held our own and our country trade has been a little better than usual and car shipments have helped out. We seldom lose a sand-lime brick customer once he is started.

"We are so congested that we cannot increase our output unless we move the brick plant to some other location, which we will ultimately probably have to do. As our experience proves, a good sand-lime brick always wins out on merit, and we certainly have always been up against it in this clay district.

"We look for good business in 1925, and believe the result of the election has cleared the atmosphere and if the Radicals and Bolsheviks in Congress can be muzzled, the general trade of the country will go on very satisfactorily."

Detroit, with five plants in operation and six more within a radius of a hundred miles or so has become quite a sand-lime brick center. In Dayton, hardly a building goes up but what sand-lime brick is used. The plants in Winnipeg and Toronto, Canada, are holding their own in those markets. New York City and vicinity have absorbed several million sand-lime brick in the last year or so. Several plants are being projected in that vicinity, in spite of the fact that considerable brick of German origin has been imported.

Good Outlook for 1925

Taking the situation as a whole, sand-lime brick producers can look forward with assurance for a prosperous 1925.

The most interesting technical development is the perfection of the Toupet process of making brick and building tile from "red-dog," the burnt slate waste of bituminous coal mines. The process is practically a sand-lime brick process, but the burnt slate ground to powder has cementing properties of its own, as well as the lime which is added to form silicates and aluminates. This process is described in more detail on the next page.

Would Have Standard Size for Sand Lime Bricks

WHEN the Sand Lime Brick Association holds its annual meeting in Toronto on February 3 and 4, there will be placed before its members a proposal for the adoption of a standard size. This proposal, which will be offered by H. Ross Colwell of the Division of Simplified Practice, is a result of a series of surveys conducted among the manufacturers of this commodity which disclosed that at present there are being manufactured sand lime bricks in five lengths, five thicknesses and four widths, or 100 possible combinations of size.

Some of the manufacturers and distributors, taking a leaf out of the book of the common brick manufacturers and concrete brick makers, asked the co-operation of the division in securing the acceptance of a standard of dimensions which call for a length of 8¼ in., a width of 3¼ and a

thickness of 2¼ in. This is virtually the same as the standard for common, rough face and concrete brick, each of which formerly were made in many size variations.

It is pointed out by the manufacturers who sought the co-operation of the division in placing this subject before the association that use of a standard set of dimensions would make it infinitely easier for architects, contractors and others, and that there would be important economies to the industry. This claim, it is declared, has been borne out by the experience of the makers of bricks of other materials.

Brick, Block and Other Building Materials from "Red Dog"

A "Sand-Lime" or "Concrete-Products" Process

By J. H. Toupet

Fireproofing Specialist, Pittsburgh, Penn.

THE Toupet-Taylor Engineering Co. of Pittsburgh, Penn., has developed a method for utilizing waste material in the making of bricks, blocks, roofing tile, plaster, coping, etc., which has been patented in the United States and Canada; although less than a year old this method is now being employed in six different plants.

"Red Dog" Is Slate

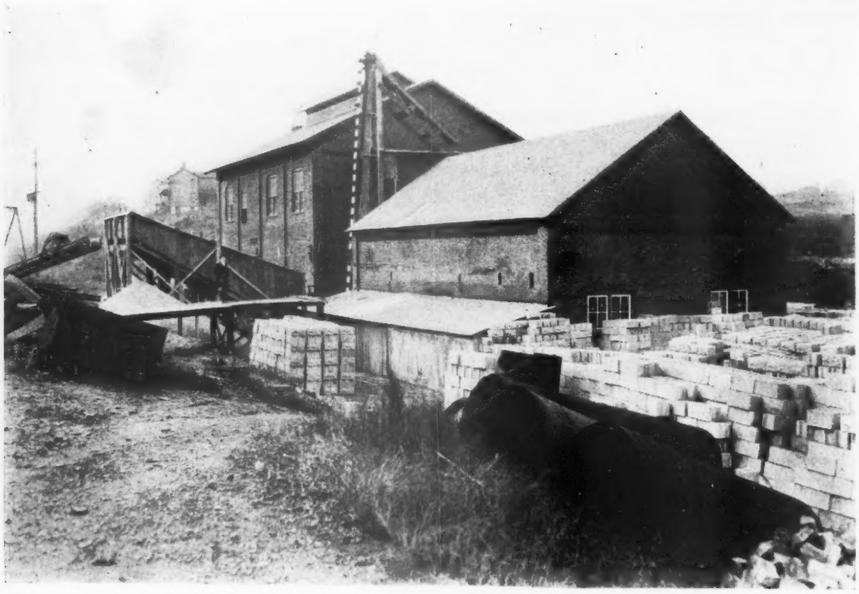
The material utilized is the waste slate produced in the mining of coal or the lignite which after burning through spontaneous combustion becomes what is commonly known as "red dog." The refuse material found at the mine is usually called gob piles. Millions of tons of this material are to be found throughout the country. The cost of delivery at the plant will range from 10c to $1.00 per ton, depending upon whether the material is utilized right at the gob pile or whether it is shipped by rail, but one may say that the cost of this waste material is practically nothing. The red dog is ground up to the fineness required for the particular product to be produced, and to this ground material is added a very small percentage of binder. In the manufacture of bricks a small percentage of lime is used. The mixture is then pressed into brick which are then carried into a cylinder to be cured, the entire process taking a little less than ten hours, or else the ground material is mixed with a small percentage of portland cement and then made into the shape of building blocks and other products and cured with wet steam. This entire process takes 24 hours.

Sand-Lime Brick Process

The first process is specially adapted to the production of a more economical brick and the second process to the production of diversified building products.

The chemical analysis of the red dog is slightly variable but fundamentally the same all over. A typical red dog analysis is as follows:

A pile of "red dog" at McDonald, Penn.



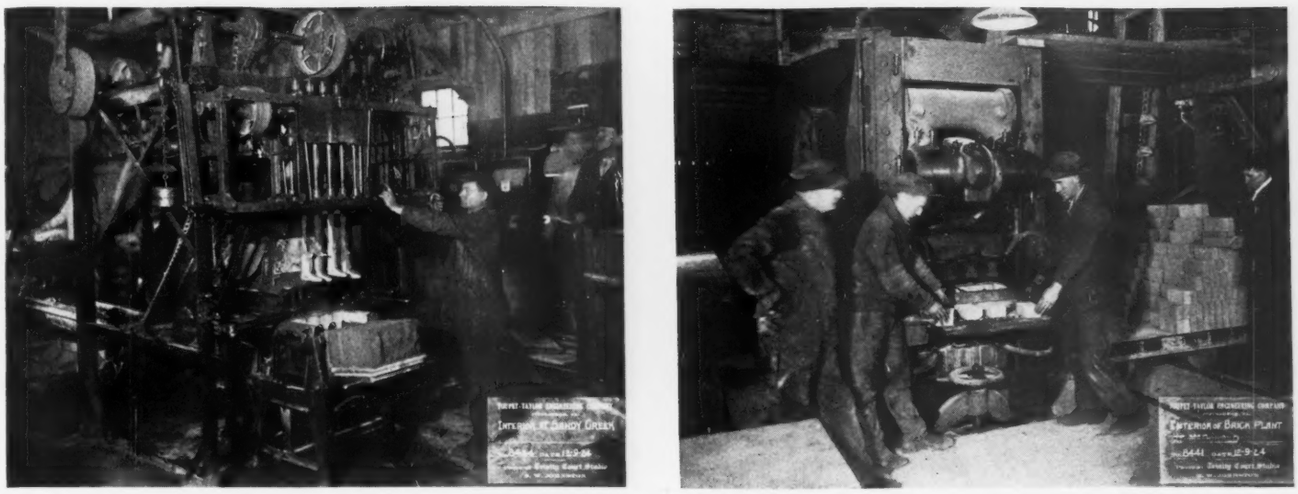
Plant of Primrose Brick Co., Primrose, Penn.

	Per cent
Iron oxide	2.00
Silica	62.10
Alumina	33.70
Lime	.09
Magnesia	.04
Loss by ignition	1.00

It can readily be seen that such material will produce a high grade fire-resisting product. The percentage of binder contained in the natural red dog will influence the additional percentage of lime in the brick, but in no case is the percentage of lime necessary to make brick over 6 per cent.

Bricks

The bricks made under the Toupet-Taylor process are made in the same manner and with the same machinery as pressed clay bricks. These bricks are of a natural color ranging from light salmon or light pink to darker shades, depending upon the iron oxide found in that particular location where the bricks are made. The color is usually light so that the bricks are the equal of the average high grade pressed clay brick.



Left—Interior of brick plant at Sandy Creek, Penn. Right—Interior of plant at McDonald, Penn.

Tests made by the Pittsburgh Testing Laboratory, Mellon Institute and others have shown that the average brick has a fusing point of almost 2,300 deg. F. (thereby making it possible to use such bricks in stacks and certain furnaces, etc.), and have shown a crushing strength varying between 4,000 to 6,000 lbs., while the water absorption ranges from 7 per cent to 12 per cent, but can be regulated by the amount of lime put in, and the pressure of the machine. Freezing tests have shown that the brick is well adapted to very cold conditions.

From the chemical analysis shown above it is readily understood that this material will expand and contract very little and that it contains no components which are affected either by a reasonable high temperature, or by water, or by climatic conditions.

Foundation Blocks and Kindred Products

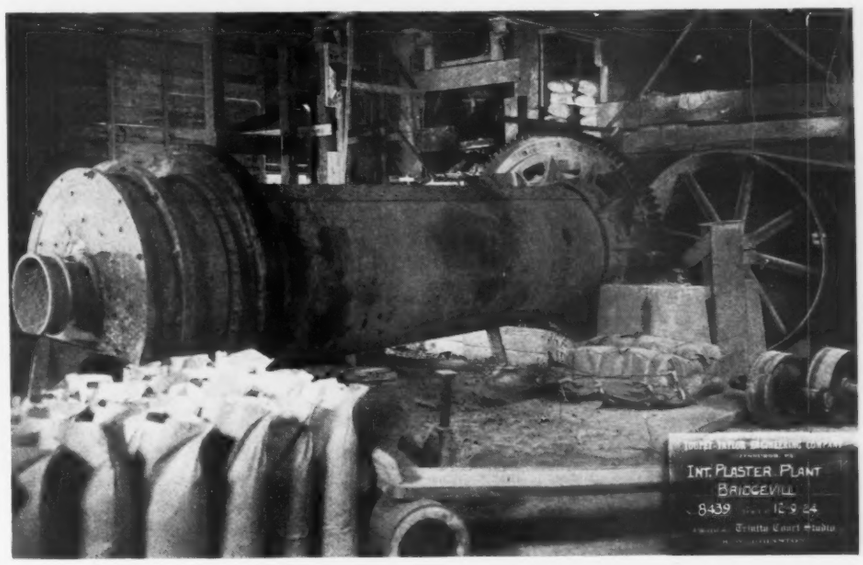
The Toupet-Taylor process for the manufacture of blocks and kindred products such as coping, roof tile, etc., is similar to that of the brick process except that such products are made by wet steam and cement is used instead of lime. This process involves a lesser expenditure in the erection of a plant. Foundation blocks made by this process are quite considerably lighter in weight than the concrete blocks usually found on the market and have a light coral color which is very pleasing to the eye. Such blocks average from 1500 to 2000 lb. crushing strength and can be made stronger by the use of additional cement. Roofing tile, copings, and window sills are also being made by the same process.

Facing of Blocks

In the making of red dog blocks it is quite important to know that no facing is necessary, which eliminates cost and trouble. The red dog material is the same throughout, the block being very plastic and of an excellent color. Rock-faced, panel, corner block, or any other effect desired is made without any additional cost.

Plasters and Mortars

The Toupet-Taylor process is also being used for the manufacture of special plasters and mortars, these products being water-resisting and fire-resisting. The color of the plaster and mortar is also a light coral or pink tint.



Tube mill in plaster plant, Bridgeville, Penn.

Plants in Operation

Brick plants: Primrose Brick Co., Primrose, Penn., capacity 20,000 brick per day; Iowa Burnt Slate Brick Co., Clayton, Iowa, capacity 30,000 brick per day. Plaster plant: Hydraulic Plaster Co., Sygan, Penn., capacity 30 to 50 tons per day. Block plants: Navarro Block and Stone Co., Pittsburgh, Penn., capacity 1000 to 1500 blocks per day; Sygan Concrete Block and Brick Co., Sygan, Penn., capacity 1000 blocks per day; Franke & Sons Brick and Block Co., Irwin, Penn., capacity 1000 to 2000 blocks per day and other products.

Generally speaking, the brick or block plants are operated with electric power, and are equipped with either a grinding machine of the crusher type or the pan type which produces the ground material. The mixers are usually continuous and mix the ground red dog with lime or cement and then a pressure brick machine of a standard make such as the Berg, Boyd, Jackson-Church, or a semi-automatic or automatic block machine such as the Hobbs, Besser, Universal, Ideal, etc.

Curing chambers for the wet steam process; that is, for the production of blocks, are large tunnels in which the wet steam is let free overnight, whereas the dry curing at high pressure such as required for brick manufacture consists of long steam tubes 6 ft. in diameter by 60 ft. to 80 ft. long in which the cars containing the brick are placed and allowed to remain for 6 to 10 hours.

Talc Industry in 1924

Not a Particularly Prosperous Year but 1925 Outlook Is Better

By Raymond B. Ladoo
General Manager, Southern Minerals Corporation, New York, N. Y.

AS in previous years, the various branches of the talc industry must be considered separately, for the talc industry is not sufficiently homogeneous so that its various parts are affected similarly by the same industrial conditions.

In Vermont the year began with prospects for good business, but about the first of May demand dropped off abruptly. Business continued very poor until the last of July, when production was at its lowest ebb for many years. Several mines and mills were closed down and others were operated at a very much curtailed rate. This serious depression seemed to affect all of the large industries consuming this type of talc and included paper, rubber, prepared roofing, textiles, etc. In August demand began to increase, first for the roofing grades of talc and more slowly for the other grades. During the fall and latter part of the year the demand was again about normal in most lines and was particularly good for the rubber and roofing grades. The demand for paper grades was in general unsatisfactory during the year. This was attributed largely to the importation of large quantities of good quality, low priced paper of the grades in which talc is normally used and to the effort by some domestic paper producers to compete with this imported paper by changing their processes and substituting other fillers for talc. Such substitutions have not been satisfactory in some cases and the use of talc has been resumed.

While no definite figures are available, it is probable that the total 1924 Vermont talc production will be considerably below normal. At the end of the year, however, all signs pointed toward good business for 1925, the outlook for roofing and rubber grades being particularly bright.

The price situation in Vermont improved somewhat during the year and this was the only thing that prevented a very disastrous year. Prices, however, have not yet fully recovered from the ruinously low levels caused by the radical price cutting in 1922 and 1923 and further stiffening in prices in 1925 is predicted.

In the fibrous talc district of St. Lawrence county, New York, the situation has been somewhat different from that in Vermont. This talc, known to the trade as Asbestine, is used largely by the paint industry and to a much lesser extent in paper and a few other lines, but it practically does not compete with Vermont talc. While no definite figures are available, it is believed that the 1924 production was equal to, if not greater than, that of 1923. One important producer states that he believes the 1925 production will be greater than in 1924. He bases his opinion not only on the general business outlook but also upon encouraging developments of new uses. The W. H. Loomis Talc Corporation of Gouverneur, N. Y., which has been a pioneer in the development of improved grades of Asbestine and in the adoption of modern, efficient milling machinery, has also been active in seeking to develop new uses. They have established their own laboratory for testing and research and they are also having research work done by a number of commercial, private and government laboratories.

A New Field for Talc

One of the most important results of the work so far has been the discovery that this talc may be used advantageously as an ingredient in concrete to make it waterproof. It is also claimed that the hardness and strength of the concrete are improved. Business is already developing in this new line. Another development has been the preparation of special grades of this talc as a high grade paper filler. Difficulties which were experienced with former grades for this use in past years have been overcome and it is stated that important savings can be shown over the use of English clay even with such clay selling at lower prices than talc.

Prices on New York talc in general remained firm during the year at the 1923 levels, but there was evidence on some price cutting by one producer. No price reductions on the best grades of Asbestine are expected in the near future, for lower prices under present conditions are not justified by the costs.

There has been little change in the talc industry in the South and it is probable that the 1924 production was certainly no greater than that of 1923. There are only a few small talc mines now in operation in the South and there have been no new developments of importance recently.

As usual, several incorporations of new talc companies were noted during the year, but (as is also usual) apparently none of these companies actually produced talc. Aside from the new uses for talc noted above, no other new uses were reported during the year.

The talc industry in general or at least that section which includes Vermont talc and similar talcs produced in other states, particularly the South, is still over-produced. Plant capacity is available far in excess of the present needs of the country, despite the fact that the number of active companies was again reduced in 1924, due to closing of mills and to companies going out of business. This continued lessening in number of active mills particularly in the south, is still over-production and of the too low price levels, which still prevail. Even the largest and most efficient producers have not prospered; they have not even been able to afford to keep their mines and mills in proper condition, to say nothing of spending money for research and new developments which are constantly becoming more and more necessary in all branches of the non-metallic mineral field. This, together with poor methods of cost accounting, has led to erroneous ideas of costs of production, which, in turn, have tended to encourage too low price levels.

Many producers in the past have failed to take these factors into account; they have allowed their machinery and plant to wear out without proper allowance for depreciation and repair; mine development has been neglected and allowances for depletion of ore reserves have not been made, and unsuitable machinery has been installed largely because it was cheap. Eventually the time comes when the results of this short sighted policy are felt. Money is needed for extensive repairs and replacements, for new shafts and new machinery and none is available from earnings. Then the producers must either close down or raise more capital. If capital is raised, the emergency is tided over and the same inefficient methods are continued. Finally, the invested capital reaches an amount so far in excess of the worth of the property that interest charges cannot even be met, no further capital can be raised and the producer fails.

This sequence of events has happened many times in the talc industry and is now happening in at least one instance. The needs of the talc industry today are the same as they have been for a number of years; namely, (1) fewer but larger and stronger producing companies, (2) higher price levels to yield a fair profit on a reasonable investment, (3) research and investigation to develop further present uses for talc and discover new uses.

Cement Mills Burn Oil

PORTLAND cement mills last year consumed 4,700,000 bbl. of fuel oil, according to the U. S. Geological Survey. The survey reports a total of 126 plants in the country, of which 18 burned oil, 107 coal and one gas. In 1922, 17 plants burned oil. Last year (1923) the plants used 30,000,000 lb. of lubricants, as against 25,000,000 lb. the year before.

Increased Output of Crushed Slag

Year 1924 Shows a Greater Production Than 1923, with Fair Prospects for 1925—New Plants Built

IN common with the other branches of the mineral industry the manufacture of crushed slag has increased considerably during 1924. Without exception every producer to whom a questionnaire was sent reported some increase and in one or two instances a definite percentage of increase was stated. Taking everything into consideration, it seems fair to estimate that there was an increase of something like 10 per cent in the manufacture and sale of crushed slag in 1924.

Prices Remain Stable

The price, in common with other forms of aggregate, has been maintained at a stable level during the year and it appears that there will be little change in 1925. There is a general feeling among producers that there will be some increase of production. For one thing, the railroads are in a favorable and hopeful situation and they will spend large amounts for ballast, concrete aggregate and the like and there is reason to believe that a fair share of this business will fall to the producers of slag.

It is however, the opinion of one of the largest producers of crushed slag that the year 1925 may see some slowing down of public improvements, as increasing taxes become more and more painful, but these will not come to a sudden stop as the inertia of the present motion is too great to permit it. It is possible that this will have its effect on the slag market and the net effect may be that a shortage in the market for material for public improvements will offset the demand from other markets, so that the production in 1925 will be about the same as in 1924.

No Labor Shortage

There has been no shortage of labor during the year. One producer points out that such a shortage may come in 1925, owing to the increased demand for labor in other lines of industry. The plants which produce crushed slag are situated in the great industrial centers in which there has been some depression during the past year and hence labor for these plants has been abundant. This condition may not continue throughout 1925.

From the same line of reasoning it is concluded that transportation conditions may not be so favorable as in the year past and some car shortages may occur.

Some important new plants were built during the year. One of these was the plant of the Buffalo Slag Co., located between the Adrian Blast Furnace and Falls Creek, Penn. This is a modern plant built of structural steel on concrete foundations and equipped to produce ballast and all commercial sizes.

This plant has a capacity for 90 tons per hour and produces 10 sizes of crushed slag, ranging from ballast and coarse concrete aggregates to the sizes used for making concrete products. It was put into production in the latter part of September.

New Plant Built in Record Time

The plant of the Keystone Slag Co., Reading, Penn. was destroyed last February. It was replaced by a throroughly modern structural steel and concrete plant, equipped and ready to produce crushed slag, in almost four months to a day, which is something of a record in the design and construction of crushing plants. This plant is interesting as it embodies the long experience of the president of the company, J. B. R. Hunter, who was one of the first men in America to produce and market crushed slag.

This plant was described in Rock Products for July 26. It is enough to note here that it employs the modern system of crushing "live" slag, that is slag which is dumped into prepared pits and excavated, often while it is still too hot to touch. The slag is carried to the plant by a 24-in. belt conveyor and passes over a magnetic separator to a scalping screen, the oversize being crushed in two No. 4 gyratories, which were about all that was salvaged from the old plant. All the product then passes to a sizing screen, the oversize being crushed in 30x16 in. rolls. The fine material is screened by electric vibrating screens. A complete dust collecting system is to be installed and the minus 200-mesh dust which this will collect is to be marketed.

Technical progress in the preparation of the slag has shown no especial novelties. The pouring of the slag from the furnaces into pits is becoming a more common practice and this has resulted in a better quality of material. The working up of the fines into concrete products is increasing, and at least one manufacturer has found that this pays much better than selling the fines as slag sand. Experiments with the use of the dust from slag crushing plants as a cementing material have been made and these experiments promise some success.

In a practical way the cementing effect of finely divided slag is taken advantage of in the manufacture of concrete products. This was brought out in a paper by C. E. Ireland of the Birmingham Slag Co., read before the Iron and Steel Institute and published in Rock Products for November 15. The cementing effect of slag is depended upon to give strength to the concrete block and a 1 to 7 mixture gives compressive strength of 2,000 lbs. Something like a 1 to 4 mixture would be required to give the same strength with ordinary aggregates of the same size. Mr. Ireland says that an even leaner mixture could be used if there was ample yard space to permit the products to season for a longer time.

This and another part of the same paper, on the "Successful Merchandising of Crushed Slag," which was published in the same issue of Rock Products, form what is perhaps the most important contribution to the literature of crushed slag in 1924.

Big Volume of Railway Work in Sight

THE railroads of the country have been given the signal to go ahead. As a consequence of their present position they can be depended on to spend nearly a billion dollars in 1925 for new equipment, maintenance and materials. Those facts have become evident at the meeting of representatives of the class I roads in session here today.

Since the railroads are the best customers of a score of different industries, this spells activity and prosperity in certain lines from one end of the country to the other. Maintenance alone requires a terrific expenditure. W. H. Kirkbride, engineer of maintenance of way and structures of the Southern Pacific Co., declares that track is constantly being rebuilt and old materials entirely replaced. The old tracks consisted of rails weighing 56 to 60 pounds to the yard. Now 110-lb. rails are being used. In the last year over 205 miles of old track have been entirely reconstructed and over 60,000 tons of rails replaced on the Southern Pacific. Each year about 2,500,000 tons are required for this road alone. These cost from $1 to $2.30 each, and cutting them requires the services of thousands of woodsmen. Substitutes have been attempted, but so far railroad engineers say that wooden ties provide the best medium for transferring the strain of tremendous traffic loads from steel rails to stone ballast.—*Chicago Daily News.*

Agricultural Limestone Production in Illinois Greatly Increased in 1924

NOTWITHSTANDING the widespread depression in agriculture during the past spring and summer and the resultant slackening in the demand for agricultural lime and limestone, one state produced and consumed more agricultural limestone than ever before in the history of the state. And the farm conditions in this state were no different from conditions in surrounding states in the "corn belt." That state was Illinois; and this increase in consumption of agricultural limestone, in spite of the most unfavorable conditions in many years, is evidently largely the accumulative result of close co-operation on the part of the Illinois Agricultural Association and the producers of agricultural limestone.

J. R. Bent, manager of the limestone and phosphate department of the Illinois Agricultural Association, has prepared the accompanying statement for us:

Character and Use of Agricultural Limestone in Illinois

"Theories concerning the type of liming material best adapted for agricultural use, and the best methods for such use, vary rather widely. The acceptance and adoption of various theories seem to be a territorial, rather than a personal, matter with the farmers. The problem is affected by the character of the material constituting the supply for the various territories respectively, the character and extent of the advertising and the promotional work and educational work that have been done in each such territory.

"Confining our consideration to various forms of raw limestone, we find that many, perhaps most, of the Eastern States have followed quite generally the practice of using very finely pulverized stone in relatively small, though, perhaps, frequent applications.

"Under the teachings of the late Dr. Cyril G. Hopkins of the University of Illinois (and his theory is still advanced by that institution), Illinois has been a pioneer in the use of larger quantities of coarser and less expensive material.

"By far the larger portion of the material heretofore used in Illinois for agricultural purposes has consisted of screenings resulting as a byproduct of the crushed stone industry. It includes all of the stone from the 'crusher-run' which will pass a ¼-in. opening.

"In the past the disposition of this material has been a problem for the crushed-stone producer and he has been glad to dispose of it at relatively low prices, sometimes actually below a ratable portion of the gross cost of production. In this way he has avoided the expense, difficulties and uncertainties involved in reprocessing this byproduct to meet specifications for other uses. The farmer in turn has been glad to buy larger quantities at lower prices and make heavy applications under Dr. Hopkins' theory. In this way, for approximately the same cost, the larger quantity of material will have sufficient fines, that are quickly available to take care of the immediate needs of his soil, and leave a residue of larger particles, which will disintegrate and dissolve gradually and so become available as there may be need, over a longer period of time— in other words, constitute a 'maintenance ration.'

"The railroads in Illinois, recognizing that this material is a crude byproduct, of low unit value, have made correspondingly low freight rates.

"Altogether, these policies in Illinois have developed, and will further develop, a large demand and use for agricultural limestone. The year 1924 will exceed all previous records with approximately a half million tons used by the farmers in Illinois this year.

"These practices and results in Illinois should be interesting not only to farmers and agricultural leaders in other states, but should also be very interesting to the limestone producers in other states."

What Illinois Quarry Men Have Accomplished

Illinois quarry men have been much criticized for their practice in selling screenings for agricultural limestone and for selling them at the prices current during 1924. But let this much be said about what Illinois quarry men have done, and the reader can form his own opinion as to whether it was good or bad business.

Illinois quarry men have practically disposed of accumulated screenings, which must be handled and stored or wasted as a part of their regular operation. In some cases it cost them 25 cents a ton to rehandle and waste them. They figure, rightly or not, that anything over and above the cost of wasting them is profit.

Illinois quarry men by cheap prices and practical co-operation of the Illinois Agricultural Association have created an appetite for limestone on the part of the farmer that is not going to diminish because existing stock piles have been shipped. The present consumption is but a fraction of that necessary to maintain Illinois soils and farmers are beginning to realize this by the best of all teachers—experience.

In the opinion of one of the state's foremost quarry men screenings have ceased forever to be a by-product. The future demand for them at least will be equal to the demand for commercial sizes of stone. Quarry men with great accumulations of limestone screenings in other states may think this was good business or not, but we venture the opinion that for a state as a whole Illinois quarry men have had as much prosperity in 1924 as in any section of the United States.

Large Orders Getting to Be Rule

We are reliably informed that Mr. Bent's estimate of a half a million tons is extremely conservative. Probably agricultural limestone consumption in 1924 in Illinois was twice this figure. We know of two quarries alone which did 100,000 tons of business each, and, we are told, a fair proportion of this was not distributed through the country agents and the Illinois Agricultural Association, but was shipped on direct order from farmers without any special solicitation on the part of anybody.

One limestone producer in the Chicago district who does have a field salesman shipped 3000 tons of agricultural limestone in a single order to a single farmer. This sale was made through a county agent.

However, in the opinion of one of the most prominent producers in southern Illinois, the influence of the Illinois Agricultural Association and the county agents is diminishing, and limestone consumption is increasing without their buying assistance (10 cents per ton rebate).

In other words, the demand for agricultural limestone in Illinois is permanent and on the increase. There will no longer exist a wholly buyers' market with large surpluses to be disposed of at cost by quarrymen. Another year is far more likely to see a sellers' market, with limestone at a premium.

How much more than the present low prices farmers will be willing to pay remains to be seen. But if they have paid present prices in times of agricultural depression, it seems certain they can afford to pay, and will be agreeable to paying, limestone producers a fair profit on all future production—which, we believe, is the goal of limestone quarry men elsewhere, as well as in Illinois.

The situation which will develop in Illinois in another year or two will help producers of agricultural *lime* as well as limestone. For with limestone screenings no longer a drug on the market, so to speak, agricultural limestone will command a price with which other forms of agricultural liming material may compete on a fairer basis.

Plans Maturing for Crushed Stone Convention

Interesting and Valuable Meeting Assured

EVERY indication points to the biggest and best convention in the history of the crushed stone industry, to be held at the Hotel Gibson, Cincinnati, Ohio, January 12-15, 1925. All the exhibit space has now been spoken for, and Secretary Sandles reports expectations of record-breaking attendance by quarry men.

Two group meeting programs are announced in detail as follows:

Highway Group Programs

H. M. Sharp of the France Stone Co., Toledo, Ohio, as chairman of the highway committee, submits the following program for his three group meetings:

HIGHWAY COMMITTEE

January 12, 1925. 1:00 P. M.

"The Crushed Stone Industry and Highways".....J. J. Sloan
President National Crushed Stone Association

"Crushed Stone Tests and Their Relation to the Service of the Fnished Pavement".....A. T. Goldbeck
Chief Division of Tests, U. S. Bureau of Roads, Washington, D. C.

"Crushed Stone and Tar Products for Roads".....G. E. Martin
Consulting Engineer, The Barrett Co., Chicago, Ill.

"Stone Screenings or Sand for Highways".....Russell Rarey
The Marble Cliff Quarries Co., Columbus, Ohio

Discussion.....Richard W. Lutz
Lutz Stone Co., Oshkosh, Wis.

January 13, 1925. 1:00 P. M.

"....." .....H. G. Shirley
Virginia State Highway Department

"Crushed Stone Products for Asphalt Roads and Pavements"....Prevost Hubbard
Chemical Engineer, Asphalt Association, New York

"Value of Co-operation Between Highway Officials and Stone Producers".....W. A. Van Duzer
Pennsylvania State Highway Department

"Crushed Stone vs. Competing Materials for Highways".....Norman Kelb
The France Stone Co., Toledo, Ohio

Discussion.....Geo. E. Schaefer
The General Crushed Stone Co., Easton, Penn.

January 14, 1925. 1:00 P. M.

"Value of Highway Research to Crushed Stone Producers".....Chas. H. Upham
North Carolina State Highway Department

"Stone Products for State Maintenance".....A. R. Wilson
Granite Rock Co., Watsonville, Calif.

Sales Group Program

Harry H. Brandon, chairman of the sales committee, submits the following tentative program for his group meetings:

MONDAY, 1:00 P. M.

Registration and Round Table Instruction.....1:00 P. M.
Luncheon Service.....1:10 to 1:40 P. M.

MENU

Eats: "What They Give Us."
Dessert: "Shop Talk."
Demi-tasse: "Swap Experiences."

Address.....1:40 to 2:15 P. M.
Sales Programs..... By.....
General Discussion of Sales Problems Affecting Highways.....2:15 P. M.
Led by—Russel Rarey, Columbus, Ohio.

F. C. Owens, Syracuse, N. Y.
Myron Edgeworth, Kankakee, Ill.
J. H. Heintz, St. Louis, Mo.
L. C. Bonnell, Summit, N. J.
Wm. B. Newman, Monon, Ind.
H. R. Williams, Carey, Ohio.
Wm. Lindsay, Hagersville, Ont.

And everyone is welcome to participate.

SUGGESTED SUBJECTS

New Developments in Highway Construction.

What should be done to effect development of secondary Highway Systems?

Discussion of Promotion Ethics.

Does Road Stone Sales Require a Research Program supported by N. C. S. A.?

Do Sales Favor Balancing "Sales to Production" or "Production to Sales?"

Does the storage and reclaiming of temporarily unsalable sizes cause the salesman to let down in his persistent effort to keep up with production, or does it relieve him of petty responsibilities and permit more time and effort in the development of a broader sales program?

Will a National or Local Advertising Campaign assist the salesman in marketing Crushed Stone for Road Construction?

TUESDAY, 1:00 P. M.

Registration and Round Table Introduction.....1:00 P. M.
Luncheon Service.....1:10 to 1:40 P. M.
Organization of Program and Election of Sales Group Officers for 1926 Convention.....1:40 to 2:00 P. M.

GENERAL DISCUSSION

Led by—A. J. Hooker, Buffalo, N. Y.
G. I. Pernell, Bellefonte, Penn.
C. H. Ruedebush, Mayville, Wis.
Ralph Morden, Columbus, Ohio.
J. C. King, Youngstown, Ohio.
U. R. Sanborn, Kankakee, Ill.
F. C. Owens, Syracuse, N. Y.
F. C. Lack, Paducah, Ky.
I. W. Wortman, Morristown, N. J.
P. B. Reinhold, Pittsburgh, Penn.
Herbert B. Allen, Philadelphia, Penn.

SUGGESTED SUBJECTS

The Crushed Stone Salesman.
What is he?
What is his importance compared with other phases of the Crushed Stone industry?
What technical experience should he have?
Should he regularly attend conventions?
Why do certain sizes of stone sell better than others?
What may be done to remedy this condition?
Should all sizes of Crushed Stone sell for the same price per ton? Why? Why not?
Should a discount be allowed on storage stone delivered out of season?
Should the salesman incur either moral or actual responsibility for collections?
What does the Sales Group expect of the Board of Directors of N. C. S. A.?
Resolutions to be presented to Board of Directors of N. C. S. A.

Attempt to Hold Up Pay Roll of the Bound Brook Crushed Stone Company

BANDITS attempted to hold up the pay roll of the Bound Brook, N. J., Crushed Stone Co., and, while they did not succeed, they killed a state policeman and badly injured another.

Charles Higgins, manager of the Bound Brook plant, which is one of the enterprises of F. W. Schmidt and his associates, was going to the bank at Summit, N. J., to get the money to pay off his men. On the way he was stopped by a man who asked some questions that raised Mr. Higgins' suspicions. In order to make sure of his safe return to the plant, Mr. Higgins telephoned the headquarters of the state police and asked for an escort. Two policemen were sent and the trip to the plant was made without any other incident than the meeting of the man who had questioned Mr. Higgins on the trip in.

While the men were being paid off, the policemen started for headquarters in their own car. A short distance from the plant they met the man who had aroused Mr. Higgins' suspicions, and began to question him. His answers were not satisfactory so they arrested him, but as they were taking him to their car three men jumped out of the bushes at the side of the road and opened fire. The man who had been arrested shot one of the policemen at close range. The others jumped on the other policeman and beat him up and disarmed him and then escaped in a car which they had in hiding.

Some Factors in Plant Design and Construction

Importance of Fire Resisting Construction and the Necessity of Selecting Right Equipment

By Wilbur G. Hudson
Wilbur G. Hudson Corporation, Contracting Engineers, New York City

IN a recent issue of ROCK PRODUCTS the following reference to the complete destruction of a plant appeared:

"The fire started apparently in an empty curing room near the center of the plant and spread rapidly until the wooden roofs were an acre of flame. The upper part of the manufacturing room, running from north to south through the middle of the plant was soon blazing and it was not long before the roof fell down upon the conveyors, motors and other equipment below.

"From there the fire leaped north to the top of the high wooden tower and destroyed the hoisting and separating machinery used in grading the gravel and sand.

"Most of the fuel on which the fire fed was furnished by the light wooden roof that extended over all the buildings of the plant. The walls are concrete and they remained standing. There were thousands of dollars worth of tile in the curing rooms and a large part of it was probably damaged by the heat."

The somewhat amazing frequency of these reports of destruction by fire emphasizes the desirability of fireproof construction, or at least of slow-burning mill construction. The mechanical and electrical equipment of plants in the rock products industries form so large a part of the total investment that it is poor economy to house these in structures of such design, that the danger of total loss is always present. Readers of this magazine can readily recall offhand six or eight plants burned out in the past year. Usually these plants are rebuilt with fireproof structures, but not always. The writer recalls one plant which was burned to the ground, rebuilt and again destroyed just when completed. Where the structures are exposed to the nearby operation of locomotives or steam operated cranes there is the probability of incandescent cinders lodging in the roof, etc. Where dryers are used, the overheating of material delivered to wooden bins is a serious danger. There are the minor risks of incendiary fires and lightning.

Under present conditions steel framed structures sheathed with corrugated wrought iron (Armco iron, etc.) cost not greatly in excess of wood structures. The design is simple; windows may be eliminated by bringing the siding up to about 2 ft. from the roof and extending the latter beyond the sides. This provides a continuous opening, ample for light and ventilation. Reinforced concrete construction is more expensive, but when completed is practically permanent, and with little or no expense for maintenance.

Storage bins of the framed timber type, while perhaps ranking as "slow burning" construction, burn fast enough under favorable conditions. We might take a leaf from the experience of the coal man who usually builds his storage pockets of concrete staves, steel plate or poured concrete. Where bins are of steel plate and for kiln dried material, it is sometimes necessary to insulate the surface to prevent water of condensation within. However, the steel silos at the Wickwire-Spencer plant at Gasport, N. Y., storing dried and pulverized limestone (Fig. 1), have been in use for two years without insulation, and with no noticeable dampening of material. Sweating occurs during cold weather while the silos are being filled with hot material, but the moisture is re-evaporated and no caking occurs. If

Editor's Note

THIS is in the nature of a criticism of the way in which much plant construction work in the rock products industries is ordinarily handled. From our own observations we believe the criticism is well founded, although there are of course many exceptions.

Rock Products wishes to aid its readers in every way to the end that money invested in new plants and plant additions is spent to the best advantage of the investor, and we believe this article gives some very helpful suggestions to this end.

Limestone crushing, screening, and pulverizing plant at Gasport, N. Y. The original plant was destroyed by fire caused by overhot material from the dryer. Note steel silos for stocking hot pulverized limestone

material is to be loaded out immediately, steel tanks should be insulated.

Importance of Selecting Right Equipment

In the methods of handling materials, there seems often to be an irresistible temptation to use the wrong type of machine to do a given piece of work. Possibly this is due to the natural tendency of man to continue to use the methods he is familiar with rather than to risk something that is strange to him. Often a single unfavorable experience will forever after bar a device or method where the experience of others has been altogether favorable. One man of the writer's acquaintance absolutely bars the use of a tripper with a belt conveyor, and insists on a movable scraper, a particularly atrocious device to the average material handling engineer. He has one tripper which has given trouble. There are hundreds which have never given trouble. Another insists on back-geared motors on all drives; although the arguments in favor of the usual arrangement of the driving group are quite sufficient for most of us.

Of two others, one would consider nothing but a locomotive crane for his reserve storage, the other would not have a crane at any price for the identical service. Such prejudices usually have a very substantial reason back of them, a reason grounded in some unfortunate occurrence.

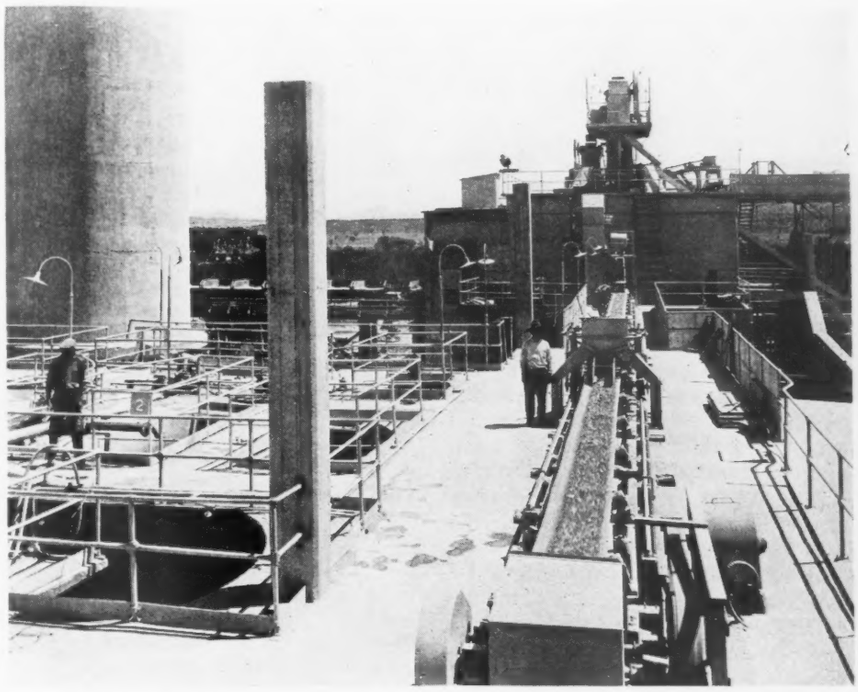
Too often the experiences originate in mechanical equipment bought on price competition. In normal times if mechanical equipment of two or three reputable bidders is about $10,000 and a third bidder's price is $6000, it does not follow that the low bid is the best, and, in fact, it will usually be the worst. We have all been through the experience of installing machinery equipment which proved to be junk shortly after it was put into service. The writer recalls a typical instance where, of two bids submitted on a crushing and conveying installation the accepted bid was just half the other, which left the high bidder with the feeling that either he had made a mistake in his figures or that the other fellow had. Two years later he was asked again to submit a bid on the same proposition and took the opportunity to visit the plant to gain a better knowledge of the conditions. The low priced job had been installed and had been in operation about 16 months. The reason for the low bid was immediately apparent. The conveyor chains were so puny that it was remarkable that they had stood up at all in service. The chain guides were 1¼x1¼x⅛-in. angles. The conveyor was driven by a chain drive from the spring release roll shaft of a crusher because this shaft was running in the right direction, thus a counter-shaft had been saved. Each time this driving shaft yielded against its springs, the drive chain snapped. A second conveyor was driven by a cable drive with ¼-in. cable, and so on throughout the entire equipment. The original low bidder was not asked to quote on the new installation and the purchaser had gained a lesson from his experience.

Breakdowns Should Be Guarded Against

The most painful fact is that a breakdown during subsequent operation involves a loss not measured by the cost of a replacement of a defective sprocket or gear as covered by the maker's guarantee. The contingent loss is the thing that hurts. Yet it is the common experience of the manufacturer, the contractor, or the engineer to hear the statement "Your bid is high", or "This bid is low," when it means absolutely nothing unless qualified by the specifications on which the price in question is based. This applies to general engineering and construction as well as to details. Specifications by shrewd (?) bidders are often drawn to so skillfully hide the things not included and to camouflage the quality of things included, that an apparently low bid is actually a very high bid. Two bids called for on a recent gravel screening plant were apparently the ratio of 4½ to 7, yet when analyzed, the bids were actually in the ratio of 4½ to 4. However, the apparent low bid was cleverly drawn and accepted. Later the owner learned it was up to him to provide various items, and do certain work, which put quite a different aspect on the transaction.

Disadvantages of Too Much Competitive Bidding

In another case a certain plant was to be built. The executives were experienced operators and knew what to specify. They secured an able engineer to lay out the plant and all went well up to the time of placing the orders for the material. They declined proposals for a complete plant and insisted on placing direct, separate orders for each unit. One bidder was played against another until "rock bottom" quotations were obtained. Several low bidders played the game set by the purchaser. The points of contact between units were missing, sizes were skimped to meet competition since price alone was to count. The low bidders were low because they were the survivors in the squeeze for cheap figures, naturally, these bidders were justified in giving the purchaser the sort of equipment he had indicated he wanted. The final result was that the cost of the plant was not as low as it might have been with a better method of purchasing on a quality basis. In the final analysis does this pay? Can we get what we are not willing to pay for? Can we compel a contractor or manufacturer to do work at a loss and not suffer ultimately for it in loss of quality?



Rock-crushing plants can be and are built entirely of reinforced concrete. The view shows the crusher building of the Victorville, Calif., plant of the Southwestern Portland Cement Co.

Failures to Live Up to Promises for Completion of Work

Another error in placing a contract for construction work is the acceptance of promises of performance which are out of line with probabilities. In a recent case

one bidder promised completion ready for operation, two weeks after receipt of signed contract. The owners were in a hurry to begin operations.

This bid with its false promise,—false, because it was, at least to the other bidders and doubtless to himself, obviously impossible,—was accepted. Three weeks later the plant, not only was not completed, but erection work had yet to be commenced. If the purchaser is inclined to accept startling promises of performance, he will do well to insist on the acceptance of a penalty-bonus clause in the contract. Many a striking promise has faded away when confronted with such an amendment to the proposal.

Some First Principles in Plant Construction or Re-construction

Let us follow the preliminary steps sometimes taken in building a new plant. The superintendent, a wide-awake fellow, pressed by the management to cut the cost of production, makes an inspection of fellow does. He has little time to spare for this purpose, frequently using his own time. His opportunity for comparison is limited and he forms impressions accordingly. He decides to ask for new equipment, and his selection, limited by the scope of his inspection, narrows down to a layout that may omit from consideration many excellent features because he has never seen them.

With knowledge of costs likewise limited, he is asked to estimate the cost of the plant he wants. Not wishing to lose the opportunity to re-equip, he makes an estimate influenced by the effort to please his superiors rather than by facts. The estimate is low. This estimate finally becomes an appropriation and bids are asked. The specifications are sketchy and when the bids are received, the management finds that they have not set aside enough money for the project. Instead of putting the responsibility where it belongs, they blame the bidders for being high, whereas they probably have done their best to make the estimate close. This results in a postponement or the redesign of the plant. If the plant is finally built, sizes and capacities are scaled down, requirements are omitted and the result is often not entirely pleasing. Why pick on an able operating man to design a plant because he knows how to run one? He knows he needs a certain rate of handling, how his kiln works best with his product, what crusher has proved best in his work, but he often does not know the recent developments in the art and whether these developments are worth while.

Example of Desirability of Special Engineering Service

One proposition is recalled where the problem was to remove finely pulverized material from a series of large evaporating pans. Certain mechanical equipment was specified for this which, while it would have fulfilled the requirements, would have been cumbersome and costly to operate. It was estimated that four men would be required with a handling capacity of about one ton per hour and the operation would have been exceedingly dusty. As an alternate a pneumatic conveyor was suggested. The owner had never heard of a pneumatic conveyor and, although the analogy with a vacuum cleaner was explained, it was only with considerable hesitation and under the most rigid guarantees of performance that the proposition was reluctantly accepted. Yet the pneumatic conveyor was ideally suited to meet the special conditions, and, as a matter of fact, gave three times the expected capacity, with the services of a single man, and dustless operation.

Why Engineer Is Needed

In the average case if the owners will retain the service of an experienced engineer or contractor actively engaged in the design and construction of plants of similar character, one who must depend on his ability, skill and acquaintance with the latest developments of the art, to stay in business; and will co-operate with this engineer or contractor, blending the intimate knowledge of their own requirements with his engineering skill, it is pretty safe to predict that the plant will be well designed, well constructed and economically built. The responsible engineer or contractor, depends for new business on the good will of those for whom he has done work. If he cannot refer to his past performances with favorable reply, he must inevitably and automatically soon pass out. This man will know how to buy, where to buy and how to do the job. He will not be tempted to take chances which, if they go wrong, will reflect much more heavily on himself than on his client. He is just as keenly interested as his client in a job well done. Nothing is more thoroughly appreciated by him than to receive from a company for which he has completed a contract, an invitation to call to discuss contemplated work. It means he has made himself "solid" with the owners by the results already accomplished and he certainly will do his utmost to remain so.

Sand-Lime Brick Convention

THE next convention of the Sand-Lime Brick Association will be held at Toronto, Canada, King Edward Hotel, Feb. 3 and 4, 1925. A very interesting and instructive program has been arranged and all those who will attend are in for a rare treat. Toronto has nine active sand-lime brick plants with a total production of over 370,000 brick daily. There will be plenty to see at these plants, if you attend the convention.

Ready for National Sand and Gravel Convention

THE National Sand and Gravel Association has issued its completed program for the annual convention to be held at the Auditorium hotel, Chicago, January 6 and 7. It is in the form of a handsomely printed booklet and contains not only the events of the sessions but a list of officers and the directors chosen from the various districts into which the country is divided and the annual report of the executive secretary, T. R. Barrows.

The program and the announcements were practically given complete in Rock Products for November 29 except for a few additions and the announcement of those who would speak on the different subjects previously mentioned. On the first day's program in the morning session, in addition to previously announced discussions, "Winter Concrete Construction" will be discussed by H. S. Wright of the Portland Cement Association; R. Snoddy, of the Coon River Sand Co., will speak on "Loading Materials in Freezing Weather," and A. E. Frosch, East Liverpool (Ohio) Sand Co., will discuss "What Discount Rate for Prompt Collections."

In the afternoon session the talk on the "Weighing of Materials and Legal Obligations of Carriers With Respect to Installation of Track Scales" will be given by Nuel D. Belnap, a Chicago attorney, the remainder of the program being as announced.

In the morning of the second day an added number will be a discussion of "Gravel as Railroad Ballast" by Robert H. Ford, chief engineer of the Rock Island Lines.

The indications are that this will be the best attended convention of the association and the program promises that it will be one of the most interesting.

L. J. Hewes Retires

THE very many friends of L. J. Hewes, for eight years manager of the district office of the Traylor Engineering and Manufacturing Co., 1414 Fisher building, Chicago, Ill., will regret to learn that he has tendered his resignation, effective January 1, 1925.

Mr. Hewes for nearly 40 years has been actively and prominently identified with the design and sale of crushing and mining machinery and has won an unusual measure of success in this line of endeavor.

He has ever been an earnest advocate of the principle that a business man should take his leisure at an age when he still has the physical capacity to keenly enjoy life, and he feels that his strenuous business career now entitles him to devote his time to recreation.

Benard Haislip, for a number of years assistant to Mr. Hewes, has been appointed to succeed him.

Work of the Bureau of Standards for 1924 in Lime, Gypsum and Sand-Lime Brick*

An Official Resumé of Important Government Assistance to the Rock Products Industry

THE number of inquiries received from the readers of ROCK PRODUCTS relative to the results of work conducted at the Bureau of Standards upon lime, gypsum and sand-lime brick indicates the widespread interest manifest in the investigations of the Bureau upon these materials. This review has therefore been prepared in the hope that it will give to the readers of ROCK PRODUCTS a better view of the work which is being conducted and that an even closer spirit of co-operation, if possible, between the industries and the bureau will develop.

It should be understood that the bureau is interested in investigations only which will result in benefit to the greatest possible number of manufacturers.

The following includes some of the more important problems which have been active during the year. Several of them have been completed and reports issued. In such cases the titles only are given, together with a reference to where the full report may be found.

Use of Hydrated Lime in Portland Cement Mortar

Portland cement mortar to which has been added hydrated lime or lime mortar to which has been added portland cement is used extensively. The proportions used run from the addition of a little lime to cement mortar to the addition of a little cement to lime mortar. For a given purpose there is obviously a mix best adapted. To ascertain these combinations has been the work of many investigators for a number of years. A phase of the problem, including the measurement of plasticity, time of set, yield, shrinkage and tensile strength, together with a resume of the literature upon these subjects, has been completed during the year. The results bring out many interesting points, including the following:

The richer the cement mortars and the higher the percentage of lime which they contain, the more mixing water is required to bring them to a given consistency.

A cement mortar with lime requires additional water, but this additional water increases shrinkage possibilities, therefore lime should be limited in cement mortars where it is desired to keep the shrinkage low. The principal advantages of lime are that it increases workability, tends to prevent segregation and may reduce permeability if used in the proper proportion. Lime retards the set of cement mortars.

The substitution of lime for an equal volume of cement always results in a decrease in strength. The substitution of lime for an equal weight of cement can not be expected to increase the strength of a cement mortar which is richer than 1:4. The addition of lime to a cement mortar increases the strength of the mortar where the mix is leaner than 1:2:5 by weight.

The desirable properties of cement-gaged lime plaster are short time of set, strength, plasticity and workability.

A study of the literature indicates that: Inert, powdered admixtures possess positive merit for reducing permeability of mortars to water when applied to mortars that are not too rich; the strongest mortars may not always have the greatest adhesion; extra sand reduces adhesion of mortars; the strength of masonry depends upon the strengths of brick, mortar and bond between mortar and brick.

Improvement of Plasticity of Hydrated Lime

A study of plastic hydrated limes brought out the following: Plasticity is not only dependent upon the colloidal state of the hydrate but the colloid must be protected against drying out, especially at the temperatures normally reached during hydration in the process of manufacture; furthermore, flocculation must be prevented when mixing water is added preparatory to use. Experimental evidence indicated that the drying out of the colloid may be prevented by allowing the freshly prepared hydrate to cool in an atmosphere of steam, and the flocculation by an addition of a small amount of a soluble calcium salt to the hydrating water. A small hydrator was erected to apply these principles. The material made in the experimental hydrator had the desired plasticity, indicating that the theoretical considerations were correct. A plant is now in the process of erection which will hydrate lime in accordance with the above principles.

On account of its cheapness, lime is being used more and more as the raw basic material in a number of chemical industries. The manner in which it is used differs considerably. Economy demands that insofar as possible the lime used shall have the properties desired for the particular purpose. The user wishes to know what kinds of lime are available and the producer the quality of lime demanded in the various industries. To promulgate this information insofar as possible, the bureau has undertaken to prepare specifications for lime for various uses. In order that the information upon the various subjects in the possession of the government bureaus may be utilized an Interdepartmental Conference on Chemical Lime has been organized to assist in the preparation of these specifications, the secretary of the conference being a member of the bureau staff. After a specification has been prepared by the conference and before publication as a circular of the bureau criticism is solicited from both the producer and user of the lime in question. During the year five specifications have been issued covering causticizing, sulphite pulp, sand-lime brick, silica brick, gas purification and ceramic whiting. Several others are in the process of preparation, including lime for use in water purification, sugar manufacture, leather manufacture and in the manufacture of double burned dolomite.

How to Make Lime Set Quickly

A quicksetting lime composed of quicklime and hydrated lime was developed at the bureau. However, this mixture does not have sufficiently good keeping qualities to be of commercial value. It was thought that possibly a cast lime tile would offer a field for the use of the quicksetting mixture. Tile were made satisfactorily both by hand and in automatic tile machines.

The major object of the research, however, that of finding a lime material to successfully compete with the quicksetting gypsum plaster, was not completely solved by the quicklime-hydrate mixture because of its poor keeping qualities. Consequently a new phase of the problem, the burning of impure limestone at high temperatures, is now being investigated.

Investigation of Plaster Failures

One of the first facts to be recognized concerning the properties of lime mortar

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is that its combination with the carbon dioxide of the air is the main reaction which leads to the formation of the bonding material of the mortar. However, definite data concerning the recarbonation process are not available and consequently this investigation was undertaken in order to obtain more knowledge concerning the reactions which may be involved in this process.

First, 144 2-in. cubes of lime mortar were made up and allowed to age in the laboratory. Four different types of lime were used in making up the mortar, so that any variation in the reaction which might be caused by this factor could be noted. Cubes from each mortar were made up with three different proportions of lime and sand so that the effect of the richness of the mortar upon the rate of the reaction could also be determined. Twelve cubes were made up from each mortar. Four of them were left as molded, four were covered with a white finish coat and the remaining four were covered with an oil paint. One of the four cubes was tested at the end of each 30 days for its carbon dioxide content and loss on ignition so that the rate of carbonation of each could be noted and so that the water content of the cubes, together with knowledge concerning its chemical combination (free or combined) could be determined.

Three definite facts were established by this investigation: (a) The penetration of carbon dioxide into a lime mortar is much more rapid in the lean mortar than it is in the rich mortars; (b) the rate of carbonation is retarded appreciably but not seriously when it is surfaced with a white finish coat; (c) the penetration of carbon dioxide through coating of oil paint is very slow, especially when it is placed on a smooth surface such as that offered by the richer mortar. This led us to believe that a coat of oil paint placed over the finish coat would stop the access of carbon dioxide altogether and consequently cubes of this type were made and allowed to remain in the laboratory for six months. At the end of this time the chemical analysis showed that practically no carbon dioxide had penetrated this surface.

The data obtained from the loss on ignition determinations, however, did not give as definite information concerning the water content of the mortar as had been expected. Consequently a careful thermochemical study of the decomposition of the constituents which may be present in lime mortar is being made in order to devise some method whereby the per cent of each in any sample of material could be determined. A system of analysis has now been adopted whereby the conditions of each determination can be definitely controlled, and where there is no possibility for the contamination of the sample during the analysis. Considerable delay has been experienced in determining the conditions under which to carry out the test and also to solve the mechanical difficulties which this type of apparatus offered. However, the point at which both calcium hydroxide and brucite [$Mg(OH)_2$] begin to decompose has been determined and with similar information concerning the other constituents of hydrated lime it is believed that a method may soon be developed for determining the per cent of each compound present.

Acoustics of Wall Plasters

It has been felt for many years that the determination of the acoustical properties of wall plaster would be of inestimable value to architects, builders and the general public. Consequently, the work has been undertaken by the bureau. A program has been prepared calling for the testing of 50 plaster panels, one-half of which are to be lime and the other half gypsum, typical examples of walls and partitions being included.

To date measurements have been made upon 15 of the panels for reflection, absorption and transmission of sound.

Data About Plastering Sands

In making sanded mortars of lime, gypsum or portland cement, it is found that the amount of water required for normal consistency decreases with an increase in the amount of sand, but that the percentage of mixing water reaches a minimum when the wet paste is just sufficient of itself to lubricate the sand, and with further additions of sand the water required increases. It appears to be possible to exclude excessively fine sands from use in mortars by setting a maximum limit to the minimum water requirement without resorting to a sieving analysis.

The properties of lean lime mortars, containing in the neighborhood of 85% of sand by weight, made from sands and hydrates of the grades used in practice, are so nearly alike that a weight specification appears to be perfectly feasible and justifiable.

Many sands which a strict adherence to the present specification for gypsum plastering sands would bar from use have been found to give satisfactory results when used intelligently.

Portland cement mortars are of better quality when made with sands low in the percentage of mixing water required with a given amount of cement. A report detailing the work of this research is now in the process of preparation.

Electrical Calcination of Gypsum

Until recently the calcination of gypsum has been a batch process. Rotary calciners are coming into favor now. It is thought that calcination by a rotary electrical calciner might under favorable conditions result in economy, better control and the production of a more uniform product. The efficiency of such a calciner on a laboratory scale has been determined and work is at present being done to determine its value with reference to the properties of the product.

Improvement of Gypsum Tile

Report of this investigation was published in Proceed. A.S.T.M., 1924, under the title "Properties of Gypsum Tile."

Rate of Drying of Wall Plasters

In order that a plastered surface be satisfactorily decorated it should be dry or nearly so. Work is under way to determine the optimum conditions relative to obtaining a dry plaster; also the time under given conditions during which plaster should be allowed to age in order that satisfactory decoration may result.

Manufacture of Gypsum Products

The preparation of a paper covering the manufacture of gypsum products has been undertaken. To obtain first hand knowledge of the methods employed in various localities 25 gypsum mills have been visited, including typical mills in all of the producing areas east of the Rocky Mountains. A study was made of the treatment of the material at each mill.

Effect of Composition on Some Properties of Gypsum Plaster

Report of this investigation was published in Rock Products, November 15, 1924, under the above title.

Effect of Moisture on Set Gypsum Plaster

Report of this investigation was published in *Chemical and Metallurgical Engineering*, August 18, 1924, under title of "Getting Rid of Efflorescence on Gypsum Plaster."

Strength of the Bond Between Mortar and Sand-Lime Brick

When brick walls fail by overloading usually the first point of failure is the bond between the brick and the mortar. The results of some investigators indicate that if the bond could be increased it would probably result in a stronger wall. To discover the factors entering into the the bond between sand-lime brick and the mortar is the subject of an investigation recently undertaken. It is planned to study all the properties of the brick together with those of the mortar. The work so far has included the accumulation of material, outlining of the program to be carried out and erection of the necessary apparatus.

Grading of Sand for Sand-Lime Brick

Report of this investigation was published in Rock Products, March 22, 1924, under title of "The Effect of Grading of Sand Upon the Properties of Sand-Lime Brick" and of April 19, 1924, under title of "Lime or Cement for Sand-Lime Brick." Also in the Proceedings of the Sand-Lime Brick Association, 1924.

Reassuring Business Outlook for 1925

Seen by Tomkins Brothers, Big Eastern Building Supply Dealers

THE spirit of confidence which became generally pronounced directly after the election still prevails and the natural result is a stimulus to trade. Practically all industries continue to reflect confidence in the sound condition of business. There are many factors which indicate that the present business revival will last many months. Some of these factors are as follows: (1) Low money rates, (2) practically full employment of labor at high wages, (3) good transportation facilities, (4) railroad buying new equipment in large quantities, (5) foreign demand for American products, (6) confidence in our industrial and political prosperity, (7) prosperity of the agricultural districts. The latter factor is one of considerable importance. The real backbone of any period of prosperity is a healthy condition of the farming regions.

The Steel Barometer

The Department of Commerce announces sales of structural steel for November, based on figures received from all of the principal plants, at 85% of capacity, as compared with 54% during November, last year, and 49% in November, 1922. The steel industry is often referred to as a reliable barometer of business conditions in this country, and with orders at 85% of capacity the mills have prospects of being busy for several months. The steel mills would not get this new business without a correspondingly healthy condition of business in general. Of course, all of this structural steel must be handled by the construction industry, which means a demand for other materials.

Large Volume of Contemplated Construction

Out of the total valuation of contemplated building projects of $517,391,800 during November for the 36 most Eastern states, the total of contracts awarded amounts to $379,659,600, which is 73% of the projects. This shows a very high percentage of contemplated work actually going ahead and the outlook for building operations, at least during the first half of 1925, is very bright.

The Trend of Construction Costs

Prices of building materials, according to the United States Department of Labor, have gradually declined during 1924, while wages have advanced. The statistics reported show that prices of materials have declined about 13% during the last 12 months, while the cost of labor has increased about 11%.

Portland Cement

The cement industry has made a remarkable record during 1924. In 1922 the production jumped from 96,000,000 to 115,000,000 bbl. In 1923 it jumped to 135,000,000 bbl. and this year it is estimated that the production will be 147,000,000 bbl. This is an increase of more than 50% in three years, and the remarkable part of it is that the mills were able to provide for this enormous increase in business and give prompt service throughout the year. Even in the busiest season shipments from most mills were made the same day orders were received. This is a record of which few other industries can boast. Stocks in the Lehigh valley district have been reduced to an absolute minimum. A few of the mills are arranging for slight increased capacity next year, but there will be nothing like the additional capacities put into operation a year ago, so that if the increase in demand next year is as great as building projects indicate, the mills might have difficulty in taking care of it. As to the price, there are no indications of a change at this time. There will be no increase in price without increases in the cost of production, and on the other hand there is nothing to indicate a decrease. With empty bins the mills will probably operate to full capacity during the winter. Coal is costing the mills a little more than a year ago and wages remain the same, so that there does not appear any reason for expecting lower prices.

Finishing Hydrate

Reports from the Ohio lime district indicate that stocks of finished hydrate at the various plants are quite low. One of the largest plants has practically no reserve stock on hand. The labor situation is very satisfactory. The supply of workmen is ample but wages continue steady. There are no indications of a change in the price in the near future.

Another Record Year Passing

The year 1924 will go down in construction history as one which has sprung many surprises on the industry. After the surprisingly high record for new construction work attained in 1923, it was not expected that 1924 would approach last year's high figures, although a satisfactory volume of building was indicated by the large number of projects at the beginning of the year. Some optimists even turned pessimistic during the decline which lasted throughout the spring and early summer months. The last half of the year, however, brought the total amount of construction for the 11 months to November 30 up to $4,154,753,000. This is not only 13% above the corresponding period of last year, but it is 4% greater than the total for the 12 months of 1923, which was the record year up to that time. According to the latest report of the F. W. Dodge Co., the greatest increases in construction this year have been in the Atlantic Seaboard States. The total November construction for the territories reporting (including about seven-eighths of the country's total) showed a drop of only 7% for October, which was the best month on record. This is rather surprising, in view of the fact that November usually shows a heavy decrease in construction from October. Last month's total of contracts awarded was $379,659,000, which showed an increase of 19% over November, last year.

Studies in Aggregate for Asphalt Pavements

RESEARCH work on the effect of grading of aggregates for asphalt pavements, made to investigate the cause of "shoving" in asphalt pavements, showed that there were very considerable differences in the ability of the mixture to resist displacement due to different gradings of the aggregate. The same sand was used in all the tests, but the sand was screened and the screened sizes were recombined in different ways. Among other things, it was found that a "light traffic" sand had really more stability than a heavy traffic sand.

The gradings of these sands were:

Mesh	Light Traffic	Heavy Traffic
10-40	30%	23%
40-80	48%	43%
80-200	27%	34%

It was also shown that the specification for asphalt sand was too restricted, as a number of sands which failed to come within the usual specification limits showed higher stability values, when mixed with 15% of mineral filler, than sands which met the specification requirements. The experiments are to be carried still further now that a method has been devised by which the stability of mixtures with various aggregates has been devised. — Abstracted from *Engineering News-Record.*

Missouri Valley Sand Producers' Annual Meeting

See Excellent Prospects for Coming Year— Discuss Competition of Unspecified Material

THE Missouri Valley Association of Sand and Gravel Producers held its annual meeting in the Kansas City Athletic Club, Dec. 16 and 17. The attendance was very good at all the sessions.

Considerable interest was felt in this meeting as it was known that several important local questions would come up for discussion including the relations of the producers to the state highway commissions of the various states represented and also the competition of some new materials which had been introduced.

Frank Peck (Muncie Sand Co.) the retiring president spoke of the growth of the association which had gained nine members and lost one. This is the first year that the association operated under the reduced dues (½c per ton) adopted last year and it was gratifying to know that these dues were sufficient to pay for the association's work and even to provide some balance on the credit side.

Capt. J. R. Stewart (Pioneer Sand Co.) brought this out in his report on the finances of the association. This showed about the same cash on hand as a year ago but less unpaid dues.

Reports from the various districts covered by the association were called for. G. E Williamson (Tulsa Sand Co.) reported from the Tulsa, Okla., district. Three new members have come in from that section in the past year. Mr. Williamson seemed to think there was danger of over production along the Arkansas as there were already 38 plants in the Tulsa district and another is going in at Dover. Practically the entire output of these plants is used in highway construction, the slump in the oil business and other things having hit the district so hard that there was very little general construction. If the highway commission is not prevented from carrying out its present plans there will be a good highway program in 1925. The commission in Oklahoma lets the contractors buy the material.

John Prince (Stewart Sand Co.) reported for the lower Kaw river. He said production had fallen somewhat in the district which was not surprising as building permits had fallen from $23,500,000 to $19,000,000. The producers for reasons hard to explain had been shut out of the Kansas market, where a good deal of unprepared sand has been sold. Noting the competition that had arisen from unwashed and unscreened material, Mr. Prince wondered about the effect of the specifications which had been developed by the highway department and others in the past few years. The companies of his district had spent a lot of money improving the plants to make material to meet specifications and the cost of producing such material had increased. Noting the use of material which would not meet specifications he was beginning to wonder if all this expense was justified.

At present, he said, business in the district was satisfactory, costs were decreasing and the prospects for 1925 were excellent. In his opinion the association had thoroughly proved its value during the period of lowered production.

Mr. Prince's remarks about specifications started a discussion. It was brought out that in certain cases material was required to pass specifications and then the bodies making these specifications threw them overboard and used material which would not pass specifications. Mr. Peck urged the members to keep track of such matters and to report such use of unfit material so that protest might be made.

Reporting from the Missouri river district, Capt. R. J. Stewart said that his company had had the best year in its history, with demand constantly ahead of production capacity. This demand promised to keep up in 1925 and he was increasing his plant capacity about 30 per cent in order to meet it. It was his opinion that the only limit to the construction of highways in 1925 would be the ability of the producers to supply aggregate. In his opinion the fate of the Missouri river sand producers lies with the stone producers since coarse aggregate is the limiting factor and no gravel is available. He understood that the highway commission was turning to asphalt in some cases where it would have preferred to use concrete, because stone was not available.

Capt. Stewart said that he believed Missouri would see its greatest demand for concrete aggregate during the next ten years and advised producers to get ready to meet it.

N. C. Dunn (Arkansas City, Kansas, Sand Co.) reported for the Arkansas river district. His report was the most pessimistic of all the reports since he reported the poorest business in three years with a loss of 14 per cent in 1924 as compared with 1923. He had some hope, however, that there would be an increased demand in 1925.

The remainder of the morning was given to J. Frank Smith of the Greater Kansas City Good Roads Association, who made an interesting talk on the effect of better agricultural methods in Wisconsin and the good roads in that state. It was illustrated with motion pictures.

Mr. Smith brought out that Kansas is the one state in the union that has no state organization for the building of roads.

The afternoon session was given up to a discussion of the annual cost report and a plan for activities of the coming year. Among other things it was decided that the association should work for the passage of a law forbidding state highway commissions to produce or purchase material which did not meet the standard specifications for highway material. This would seem to be a curious law, as highway commissions make these specifications, but the experience of the producers seemed to prove that such a law was necessary.

The following morning Mr. Kaufman, the Kansas City representative of the Portland Cement Association gave a most interesting talk on the aggregate situation in the district. He said it was the intention of the Portland Cement Association to give the aggregate situation something more than the "once over." In general it seemed to him that there was plenty of sand but not enough coarse aggregate in the district. There was a considerable use of unfit aggregate and a great deal of bad aggregate had gone into concrete products.

Uncompleted Contracts

As to future business an accurate account showed that there were contracts awarded and not completed to call for 58,820 yd. of concrete for roads and streets in Kansas and 12,000 yd. for structural work. In the same way there was called for in Missouri 417,000 yd. for roads and streets and 20,000 for structural work. Nebraska would need 16,600 yd. for roads and streets and 6,000 for structural work; Oklahoma 107,100 yd. for roads and streets and 14,000 yd. for structural work, and Arkansas 88,400 yd. for roads and streets and 4,000 for structural work.

In the five states mentioned there is enough in sight to call for 350,000 yd. of sand, of which 60% will go to Missouri alone.

Mr. Kaufman spoke of the increasing use of concrete on the farm and thought that county agents should be shown why only washed and screened aggregate should be used.

E. C. L. Wagner who had been employed by the association to investigate the use of crushed chats, the refuse of the Joplin district zinc mills, made a brief preliminary report which brought out some of the differences between crushed chats and Kaw river sand. Some of these were:

	Kaw River Sand	Crushed Chats
Specific gravity	2.63	2.50
Wt. per cu. ft., lbs.	111.00	91.00
Wt., solid, per cu. ft., lbs.	164.00	156.00
Wt. with 7% water lb.	97.00	72.00
Bulking	22½%	35½%
Voids	32%	42%

This indicates it would take considerable more cement (about 31 per cent) to make concrete of the same density.

The workability of crushed chats concrete was found to be much less than that made of natural sand. Crushed chats had been turned down in one county in Kansas because the concrete did not finish well, it required too much tamping and the finished concrete showed a tendency to scale. For structural work crushed chats would probably be found much less resistant to fire.

The nominating committee then brought in its report and the following officers were elected: President, W. E. Rogers, Arkansas River Sand Co., Tulsa, Okla.; vice-president, R. J. Stewart, Pioneer Sand Co., St. Joseph, Mo.; treasurer, N. C. Dunn, Arkansas City Sand Co., Arkansas City, Kansas.

The following were elected from the districts mentioned to form the executive committee: Oklahoma, J. H. Boss, Producers Sand Co., Tulsa, Okla.; upper Kaw, Otto Kuehne, Kansas Sand Co., Topeka, Kansas; Arkansas River, R. H. Cubbon, Jackson-Walker Coal and Mining Co., Witchita, Kansas; Missouri River, H. E. Fisher, Glasgow Sand Co., Glasgow, Mo.; Lower Kaw, C. W. Bartlett, Kaw River Sand Co., Kansas City, Mo.

The social features of the meeting, which were provided by the Kansas City producers, were the success that they have always been. There was a theatre party ("Abie's Irish Rose") for all the producers the evening of the first day and a banquet the evening of the second, beside lunches served at the club, on both days. The banquet was attended by about 200 people, and it was a very successful affair. The entertainment by professionals was good and that furnished by producers who were conscripted and made to display their talents as singers and speakers caused even more pleasure to everybody but the performers. Major Bartlett, who was chairman of the committee on entertainment and largely responsible for the form it took is to be congratulated on the success of the affair and the cordial and happy spirit he was able to instill into the party.

Wisconsin Mineral Aggregate Association Meets

Elects Officers for the Year and Attends the Annual Banquet

THE Wisconsin Mineral Aggregate Association, which is one of the most enterprising of the various state producers' associations, held its annual meeting and banquet at Hotel Pfister, Milwaukee, December 18.

The Wisconsin association holds regular monthly meetings, and its by-laws are so constituted that any business of importance may be transacted at these monthly meetings. This is a method which might recommend itself to other associations, as in this way the work is always kept up to date. So at the annual meeting there are no unusual features outside of the election of officers for the ensuing year and the reading of the annual reports.

Nevertheless, the attendance was excellent, practically all of the companies which are members of the association being present.

President Jensen called the association to order and made a brief speech, stating the purposes for which the meeting was called, and then appointed a nominating committee to select the candidates for the annual election.

In doing this, Mr. Jensen said that he felt that some changes should be made, and asked that the committee present a "slate" of new names, since he thought it only fair that other members should have a chance to bear the responsibilities and assume such honors as went with the position. The committee evidently considered the matter from his standpoint to some extent, as some changes were made from the list of officers and executive board of last year. The report of the committee was accepted and the following were declared elected for the ensuing year:

President, J. K. Jensen, Janesville Sand and Gravel Co.

Vice President, John D. Ohrt, of Davis Bros. Stone Co.

Secretary,Treasurer, Edward E. Gillen, Waukesha Lime and Stone Co.

Members of Executive Board: R. C. Brown, Sr., Western Lime and Cement Co.; M. W. Deutsche, Racine Crushed Stone Co.; Dr. C. R. Nutt, Moraine Gravel Co., and Louis Laun, Elkhart Sand and Gravel Co.

The last named member of the board died on Christmas day, according to a telegram received from the association.

The secretary-treasurer, I. M. Cliquinoi, Wisconsin Sand and Gravel Co., read the annual financial report of the association, which showed its condition to be about the same as last year, although the dues had been reduced, as told in the report of the 1923 meeting in the Annual Review number a year ago.

The executive secretary, N. K. Wilson, read his annual report of the association, mentioning, among other matters, the adjustment of differences regarding inspection and sampling of cars. The relation between the highway bodies and the association were of the pleasantest, which made any adjustments easy to make.

Mr. Wilson said that there had been laid about 283 miles of concrete highway during the year just past and all but a small part of it had been of cleaned and screened material, such as is advocated by the association. It was evident that competition from the wayside pit was constantly decreasing.

The association carries on a constant advocacy of the use of cleaned and screened material, both through publications and associations which devote themselves to such work, and the activities of the association in that line for the past year were explained in the report.

Among other matters which were discussed at the meeting was that of securing a lien law which should apply to public work. A. J. Blair of the Lake Shore Stone Co. explained the present law applicable to liens on private work, and said he thought the same method might be applied to public work. It means that notice must be given by the producer that he is supplying the materials.

The banquet in the evening was considerable of a social event, as about 200 persons sat down to the table, the guests outnumbering the members and their families. There was an excellent dinner, with a very good entertainment. There were a number of speeches, that which was most interesting to the producers, perhaps, being made by Chief Highway Engineer Donaghue. He said he would like to hold out the hope that a thousand miles or so of concrete road would be constructed in 1925, but could only say positively that about 100 miles would be built.

Find Potash Sand in Oklahoma

THE United States geological survey has found red potash sand in western Oklahoma, and has geologists looking for the sand in paying quantities, Charles N. Gould, representing the department in Oklahoma, announced recently.

According to Gould, the world depends on Germany for its supply of potash, an industry which runs into millions of dollars annually. Geologists believe western Oklahoma and Kansas will produce enough to supply America, Gould said.

"This is an industry about which the average person knows little, but it is one of the biggest things the department is working on now," Gould declared.—*Oklahoma City (Okla.) Times.*

Limestone Subject for Engineers' Convention

One of the Principal Sessions of the Coming Annual Meeting of the American Institute of Mining and Metallurgical Engineers Will Consider Limestone in Some of Its Important Industrial Phases

By Oliver Bowles, M. Am. Inst. M. M. E.

LIMESTONE, the king of all the nonmetallics, has attained a new dignity, a recognition it has long deserved but has failed to command except in limited degree. The American Institute of Mining and Metallurgical Engineers, an association of over 9,000 members including the leading men of these professions in America, will meet in annual convention in New York City in February, and plans are now nearing completion to devote the importat mining session to a discussion of limestone and its products. The Institute has in the past confined its deliberations almost exclusively to problems in petroleum, coal, metallic ore mining and metallurgy; never in its recent history has limestone commanded more than passing notice.

The attainment of this new recognition has been a slow and tedious process. The quarrying of limestone dates back to antiquity, and the methods, until recent years, have been very crude and unscientific. Gradually the uses of limestone have increased, the two greatest strides in the path of progress being the development of the manufacture of lime and portland cement. With the growth of these great manufacturing industries new refinements were demanded. Limestone ceased to be just limestone; it was found that there were hundreds of different limestones of varying adaptability. Chemists were required to determine the properties of the rocks, and chemical control became a necessity in the manufacturing processes. Highway and concrete construction have brought about a tremendous growth in the crushed stone branches of the industry, and with the erection of larger and larger plants engineering skill has become a factor of increasing importance.

The desire for mutual advantage through exchange of ideas led to the organization of state and national trade associations. At first they provided merely a meeting ground to discuss business matters; later technical papers were read and discussed, a natural outgrowth of which, in some of the larger and more progressive associations, was the organization of research laboratories maintained by the industries. The National Lime Association and the Portland Cement Association are outstanding examples of this advanced policy. The results of studies conducted in their laboratories have helped materially in improving the quality of products, in simplifying processes of manufacture, in widening the market, and in educating the consumer in the most intelligent use of cement and lime.

The tremendous industrial demands for limestone and its products amounting to approximately a million dollars a day for every day in the year, have led to enormous investments in quarrying, crushing, screening, calcining and grinding equipment. The establishment and operation of plants capable of handling several thousand tons of stone per day requires the highest type of engineering skill, and the engineer is becoming a more and more familiar figure around limestone plants.

Program Interesting to All Limestone Producers

Another step toward a well-deserved recognition of the importance of the limestone industries was accomplished with the establishment in 1923 of an experiment station of the Federal Bureau of Mines to conduct industrial research in various branches of the limestone and other nonmetallic industries. The writer, who is suprintendent of this station, is secretary of the Non-Metallic Committee of the American Institute of Mining and Metallurgical Engineers and his efforts during the past year, ably seconded by the editor-manager of ROCK PRODUCTS, also a member of the committee, and by Prof. Ries, of Cornell University, chairman of the committee, have resulted in a program of papers constituting a basis for a symposium on limestone at the coming convention. The proposed program together with the discussion that may result therefrom should be of interest both to engineers and limestone producers, for the subjects are divergent in character and will be presented by men well qualified to speak with authority. "Limestone production as a mining problem" will be presented by J. R. Thoenen, mining engineer, now in the employ of the Bureau of Mines Nonmetallic Station engaged in detailed studies of limestone mining. Cement, the most important branch of limestone producing activities will receive due recognition in a paper on "Some manufacturing problems in the cement industry" by John J. Porter, 1st vice-president and general manager of the Security Cement and Lime Co., Hagerstown, Md. Mr. Porter is well known to the cement industry through his activities on the technical committees of the Portland Cement Association.

A Valuable Publication

Are you considering the advisability of undertaking a limestone project? If you know approximately the cost of production, the selling price, the extent of the necessary investment and the life of the deposit, a paper by C. C. Griggs on "Engineering in limestone production" will tell you how to determine with mathematical precision the profit or loss that may be expected from such an enterprise. Mr. Griggs who has recently been promoted to Assistant Head, Engineering Division of the Internal Revenue Bureau, is well known in the nonmetallic field and his statements are authoritative. Limestone producers who may be in the New York district between February 16 and 19, whether members or non-members of the Institute, are cordially invited to attend this or other sessions of the convention which will assemble in the Engineering building, 29 West 39th street.

There has always been a great gulf between the mining and metallurgical engineering professions and the limestone industries. A few men have thrown cables across the chasm, but their efforts have met with little response from either party. Has the time now arrived when these strands are to be consolidated into a secure bridge of co-operation? To accomplish this task a greater number of the leading men in the limestone industries should seek membership in the American Institute of Mining and Metallurgical Engineers and actively participate in its work; and the mining and metallurgical engineers should awaken to a realization of the fact that in the limestone industries there are innumerable problems of a magnitude and complexity worthy of their highest attainments. If such results are realized, even in a degree, the coming limestone symposium will constitute another milepost in the march of mining and metallurgical progress.

Plant Designed for Producing Marble Dust and Granules

Conlin Marble Company's Plant at Tuckahoe, N. Y., Is Not a By-product Plant But Crushes All the Quarry Output to the Finer Sizes

By L. H. Sturtevant
President and General Manager, Sturtevant Mill Company

PLANTS producing ground limestone and similar products are usually byproduct plants. The plant of the Conlin Marble Co. at Tuckahoe, N. Y., is unusual in that it was designed to grind the whole quarry output into the finer mesh sizes of materials and not merely the byproducts of coarser crushing.

This plant is unusual for its completeness, its flexibility and the number of products it can produce; in fact, it can meet any demand for crushed, granulated or pulverized marble from 3 in. in size to 300-mesh by simple and quick adjustments.

The stone is brought from the quarry in 2-ton skips on an overhead cableway, discharging on a large platform above the 26x14-in. jaw crusher. This platform is movable to allow easy access to the crusher. The jaw crusher is of the double cam and roll type which operates at slow speed and is therefore durable. It is driven from a countershaft which in turn is driven by a 30-h.p. Westinghouse motor.

The discharge from the crusher falls into an 18x8-in. inclined double strand chain, continuous bucket elevator of 30 ft. centers, which carries the stone, now crushed to 3-in. and finer, to the secondary crushing equipment. The elevator discharge is split two ways, each half passing by gravity into a No. 2 "Open-Door" Sturtevant motor driven rotary crusher, each crusher connected through silent chain drive to a 20-h.p. General Electric motor.

Experience in its old plant has proven to the Conlin Marble Co. that the rotary crushers produced stone of exceptionally good shape for their various products, and therefore these were adopted for the new plant. These crushers are of a rugged type and unusually accessible, owing to the open door construction, and are capable of fast and continuous production of ⅜-in. stone, containing a minimum of fines.

Both rotary crushers discharge into one open door steel encased elevator, carrying 12x17-in. buckets mounted on a combination chain, operated by a 7½-h.p. motor through a double gear reduction, the first running in oil, mounted on the elevator casing. This elevator is 44 ft. between centers, has a split head, ball and socket bearings, steel boot with automatic safety take-ups and a clean-out door, also other doors conveniently located for accessibility. The casing is tightly sealed against the escape of dust.

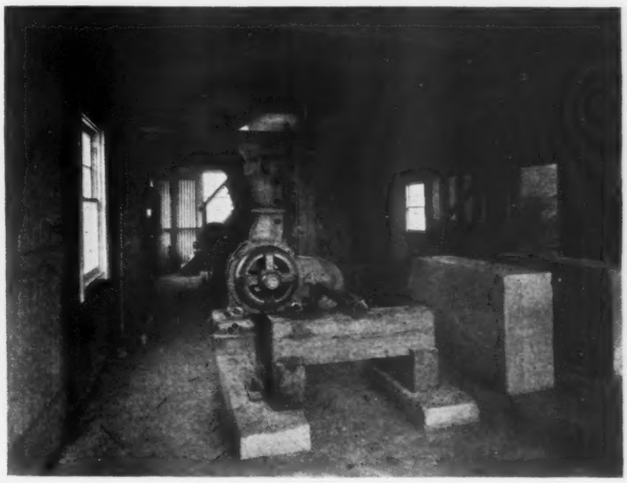
To produce the first separation, the elevator discharges into conveyors which evenly distribute the material over two double deck heavy duty "Moto Vibro" screens, producing three products, the first of which is oversize, the second the required product and the third fines.

These heavy duty screens are thoroughly accessible and have a positive and rapid vibration of small amplitude, not sufficient to be destructive, yet of such intensity as to keep the meshes open, prevent the material from racing and thus skipping over the screen surface and produce a large and accurate tonnage. They are driven by a 2-h.p. motor.

The oversize or first product passes by gravity to a set of 20x14-in. crushing rolls. These machines are of balanced construction, especially suited for granulation, and produce a minimum of fines. They are quiet running and have an accurate and easy hand-wheel adjustment for changing the roll opening while in operation and they are driven by a 10-h.p. motor.

A screw conveyor placed under the rolls carries the recrushed material to the same elevator, which serves the rotary crushers and both crusher and roll products pass over the screens together, but only the rolls recrush the screen oversize.

Owing to the contour of the ground, the rotary crushers, rolls, elevator, and screens



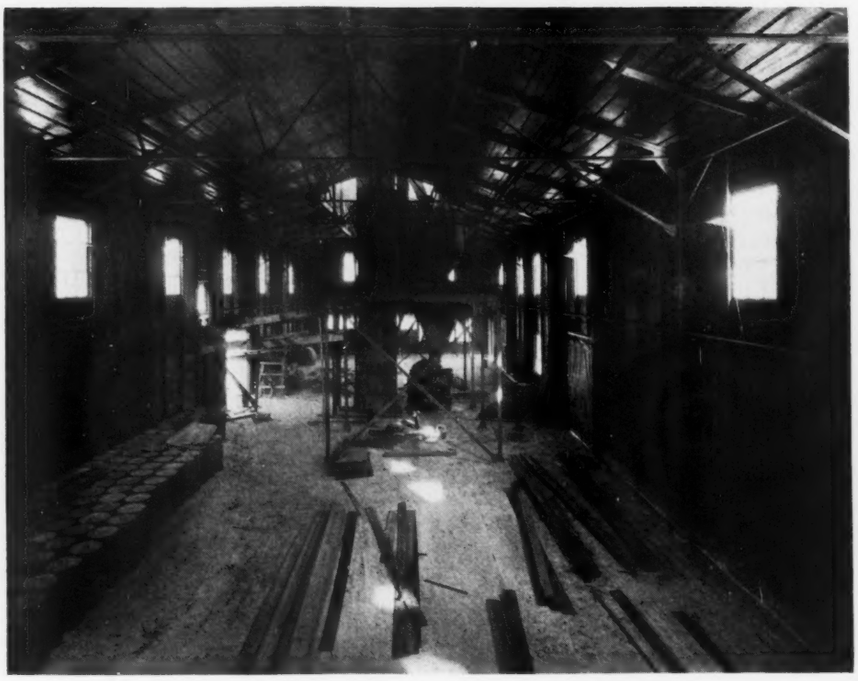
Left—View from south showing jaw crusher, elevator, and intermediate crushing plant on left, belt conveyor gallery, storage and fine-grinding building on right. Right—First floor of intermediate crushing plant showing motor driven rotary crushers. Roll foundation shown on right

are placed in one building at a higher elevation than the jaw or preliminary crusher.

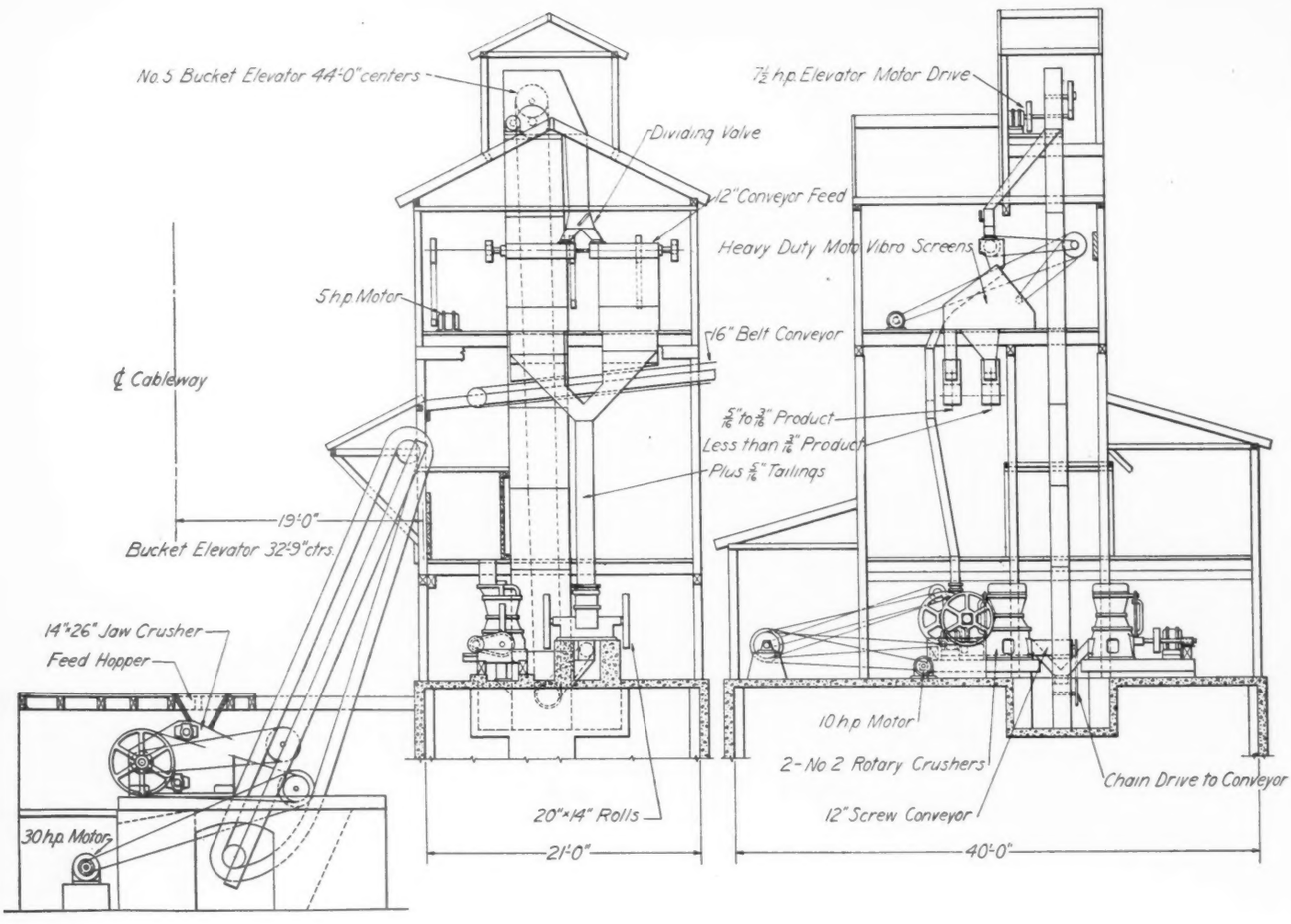
After the oversize has been reduced, there are two products, the fines which are later reground in the ring roll mill, and separated by screens or air separation to the various grades, and the coarse particles which are to be regulated in size to suit the stucco or concrete trades. Again owing to the side hill location, there is only one available space for the storage and pulverizing building to allow for side tracks and shipping. A "Trus-Con" steel building, 40x140 ft., was erected in this space and the two products are carried from the screens by two 16-in. inclined belt conveyors, a distance of 40 ft. into this pulverizing and storage building. The first finished or coarse product (made by the screens mentioned) is delivered into bins from which it is bagged or shipped in bulk. In the latter case a portable belt conveyor carries it directly into the cars.

The fines are handled in several different ways, depending upon the trade demands. Sometimes one screened product is wanted, at other times a carefully graded granular product in several sizes is required and again an impalpable dust is demanded.

Therefore, to meet this varying demand promptly, a special pulverizing, screening air

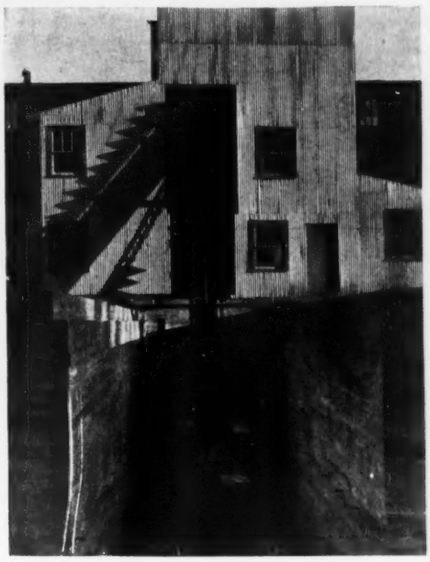


Interior view of steel building showing ring roll mill, air separator, screen unit for fine grinding and sizing



Longitudinal and cross sections of crushing plant

separating plant has been installed, having great flexibility so as to produce any product for which the Conlin company has a demand. An Open Door No. 2 ring-roll mill, working in connection with Moto-Vibro screens and Sturtevant "Whirlwind" centrifugal selector meets every requirement as a separating unit, for where one or more granular products coarser than 60-mesh are wanted, the air separator is bypassed and only the mill and screens are used, but when a product of 60-mesh or finer, up to 300-mesh, is called for then the screens are bypassed and the centrifugal selector is used.



Primary jaw crusher and bucket elevator

Can Make Three Sizes or One as Wanted

The mill discharges into an elevator, carrying 14x7-in. buckets, which lifts the material sufficiently high to deliver either to the screens or air separator. As the Moto-Vibro screens are three deckers, they can produce three different sizes without the oversize or only one size as wanted.

The oversize from either the screens or the air separator is returned to the ring-roll mill by screw conveyors, making a closed circuit operation.

The mill requires no adjustment as the separating devices regulate the product. The screen cloth is changed to make the product desired. The air separator is easily adjustable while operating within the range above mentioned.

Sacking hoppers under screens and air separator are used for bagging finished goods.

The entire plant is not only equipped with accessible and durable machinery, but it will produce accurate outputs within an almost unlimited range.

It was designed and equipped throughout by the Sturtevant Mill Co. of Boston, Mass.

New Gravel Company Forming in Southeast Missouri

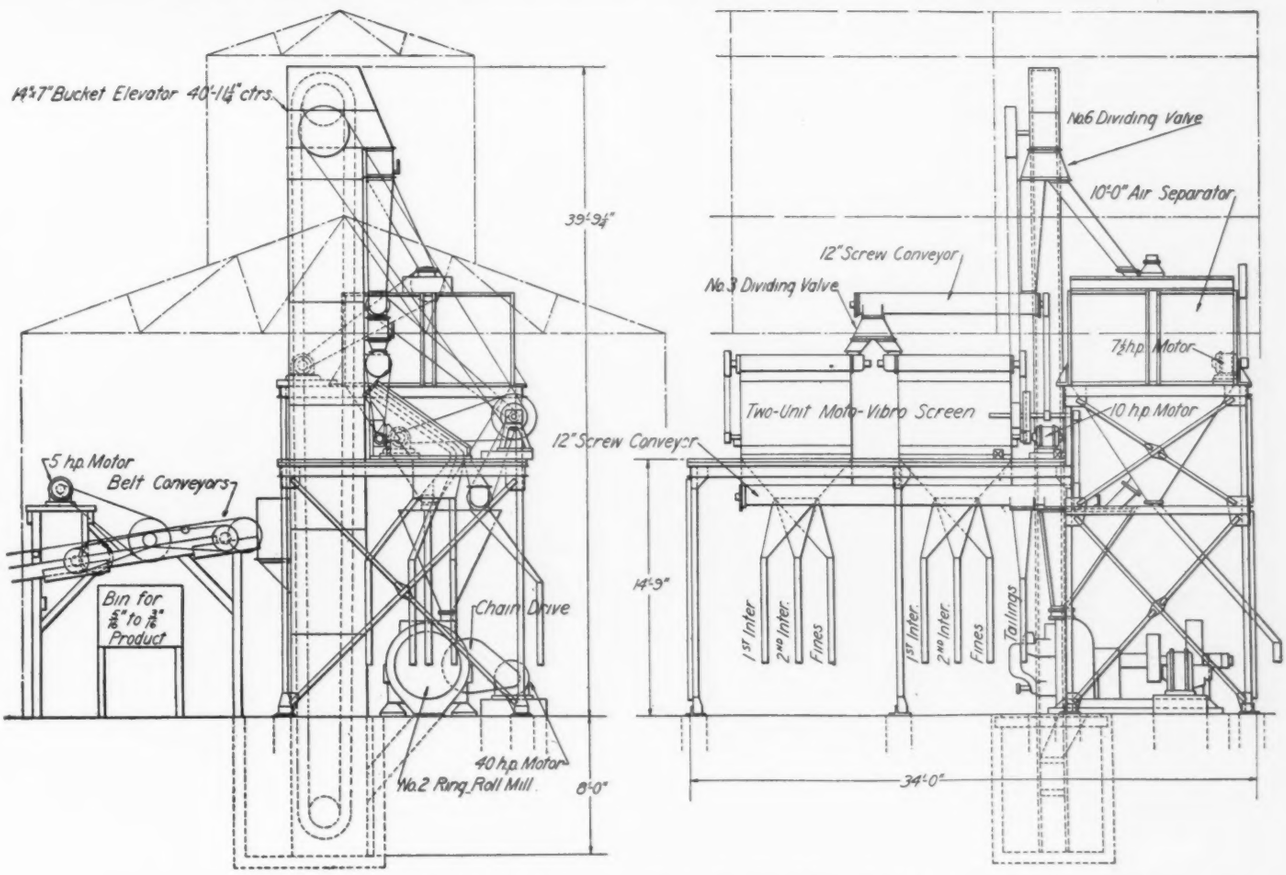
LOCAL business men of Fredericktown, Mo., are organizing a company to handle the gravel and sand needed in the pavement of Route 9, contracts for which have been secured.

The men so far interested in the project are Hugh H. Humphrey, R. H. Davis, C. L. Whitener and A. D. Brown, but there may be others later.—*Fredericktown (Mo.) Democrat-News.*

Cloth-Screen Dust Collector

ANOTHER manufacturer of dust collecting apparatus who began with sand-blast equipment is the J. W. Paxson Co., Philadelphia, Penn. Since then they have made a number of installations in the rock products industries, including those at the plants of the Charles Warner Co., Wilmington, Del., and the Lawrence Portland Cement Co., Siegfried, Penn.

The Paxson collector is constructed with a steel casing made of No. 16 steel plate, reinforced with angle iron corners, and stiffeners. Casing is fitted inside with rigidly constructed, cloth covered screens, through which the air passes, the dust adhering to the screens and being removed by means of a knocking device, falling to the bottom of the collector, which is in a hopper shape, being discharged underneath the collector.



Longitudinal and cross sections of pulverizing plant

Eliminating Dust for Both Profit and Humanitarian Considerations

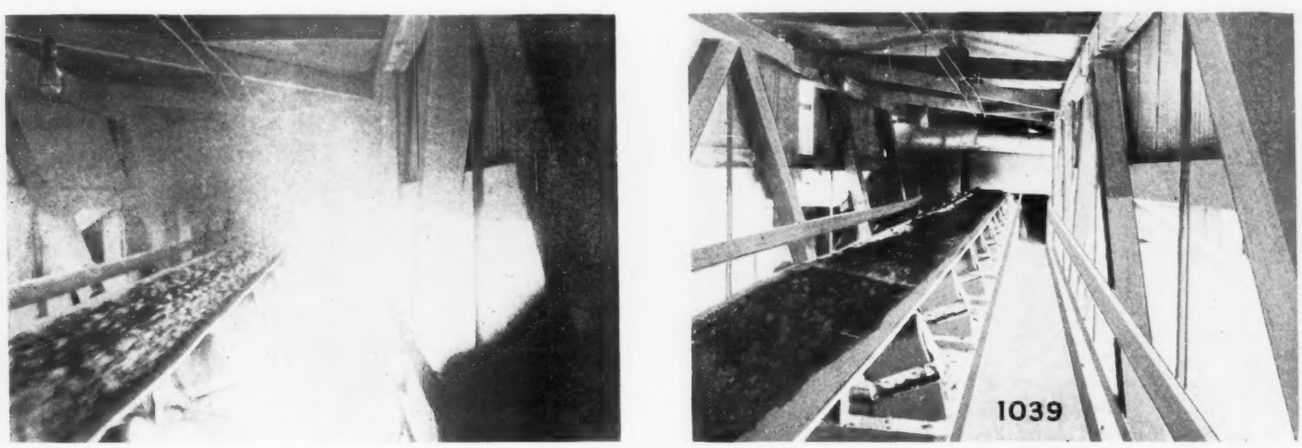
Great Progress Being Made in the Rock Products Industry

By H. W. Gaekle
The W. W. Sly Manufacturing Co., Cleveland, Ohio

EVER since man has attempted to produce a finer article out of a base source, the dust evil has confronted him. For years, it was taken for granted it was a necessary evil which had to be endured, but gradually as thought was put on the subject, it was seen how comparatively simple it would be to overcome this evil, improving the working conditions and recovering a valuable product—in many instances, the most valuable product of the plant.

To find the original dust arrester, we have no farther to look than the human system. Before air reaches the lungs, it passes through the nostrils where the suspended matter is removed. This suffices in those cases where the air is not heavily laden with dust. As conditions became worse and the air was filled more and more with fine particles, methods were tried to improve this condition.

One of the first men to give thought to this subject was W. W. Sly founder of the W. W. Sly Manufacturing Co., of Cleveland, Ohio. A half century ago, he invented a revolving barrel for the cleaning of castings by tumbling. Always seeking to improve his product, his attention was soon drawn to the loose sand and dust which was knocked from the castings. He decided that if this could be collected in a manner which would readily permit of its easy removal to a dump, it would not be blown about the works. Accordingly, he invented and patented the cloth type of dust arrester, and the idea was quickly seized upon by the trade to which he catered at the time,



Left—Conveyor in Blue Diamond Materials Co. plant, Los Angeles. The stone fell on the belt from a disc crusher, causing the dust cloud shown. Right—The same conveyor in operation after the dust-collecting system was installed

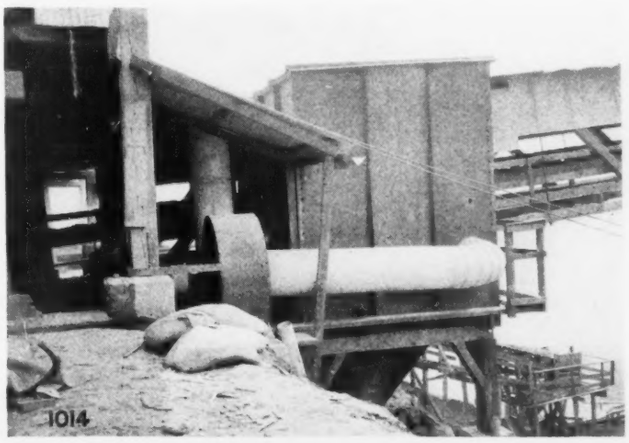
E. H. Bradbury's crushed-stone plant operating in the heart of Kansas City. Left—Before the dust-collecting system was installed. Right—After the dust-collecting system was installed

and this invention continues to hold its prestige to this day. Prior to this, there undoubtedly were some crude devices used for the collection of dust, but this was the first positive type of collection known.

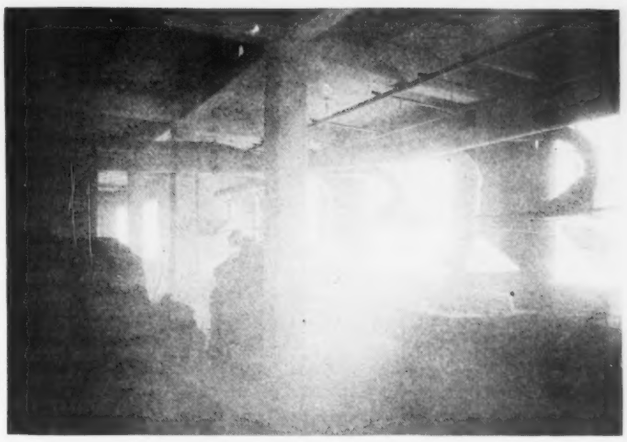
First Installation Demanded to Prevent Nuisance

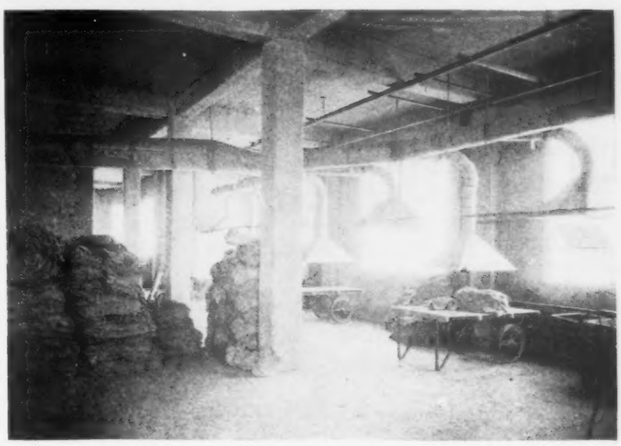
As industries expanded, and the amount of dust thrown out by grinding plants increased, complaints were forthcoming by the communities in which they were located, that the dust conditions were unbearable. In one particular instance, about 1910, a firm in the east, engaged in the manufacture of pearl buttons, whose plant had been far outside the city, saw the city move out and around its plant. They soon became the object of an organized attack by their neighbors who demanded that the nuisance of the fine white dust which was being literally scattered over adjacent property should be abated. In investigating the possibilities of relieving this condition, their attention was drawn to the type of dust arresters used in foundries, and Sly engineers were called upon to devise a means of collecting this dust. A Sly positive dust arrester was installed which overcame their trouble so easily that they were able to continue in business at their old location. This installation was the first outside of the field for which dust arresters were designed, and the motive was an expedient to still the criticisms of adjacent property owners.

A few years later, another firm discovered that for years a very definite percentage of their valuable product was being dissipated into the atmosphere, and that if it could be collected, a very substantial addition to their production would be effected. The dollars that were continually escaping into the air were soon converted into additional profit. This motive was purely for financial gain.



Left—Dust-collecting system in a New England trap-rock quarry. Right—Removing the collected dust which is sold for asphalt filler





Left—The bagging room in a cement plant before a dust-collecting system was installed. Right—The same room after the dust-collecting system was installed

Protection of Workers Demanded by Law

About the same time, there was considerable agitation and legislation due to the activities of welfare workers and state industrial commissioners to which was added data compiled by the medical profession condemning the methods of certain groups of manufacturers not protecting their workers against the harmful effects of dust. It was claimed that the average life of those working in silica dust was ten years, while certain types of dust were fatal and others rendered the employees susceptible to the ravages of pulmonary diseases. Many such firms have either been compelled to abate the danger or have anticipated such action by voluntarily installing dust arresters. In most instances, the manufacturer later discovered that the product collected was the finest and most valuable part of his product, while in others, a market was easily found for the dust. In these cases, the installation is returning a substantial interest on the investment in recovering a salable product in addition to lowering the labor turnover.

Maintenance of Machinery

Another phase of dust collecting was brought about during a thorough investigation of the reasons for the high maintenance costs on electric motors and the moving parts of other machinery in those industries that had a gritty substance suspended in the air. The frequent burning out of motors, and the excessive wear on bearings with the consequent loss of pro-

duction became such a problem that one of the large electric motor companies was called in for consultation. First an attempt was made to improve the insulation which gave some relief in that the motors did not burn out so frequently, but it was finally decided that the excessive quantity of abrasive dust, which also happened to be an excellent electrolyte, was responsible for the excessive maintenance costs. Dust arresters were installed and the trouble eliminated.

Interest in Cement Industry

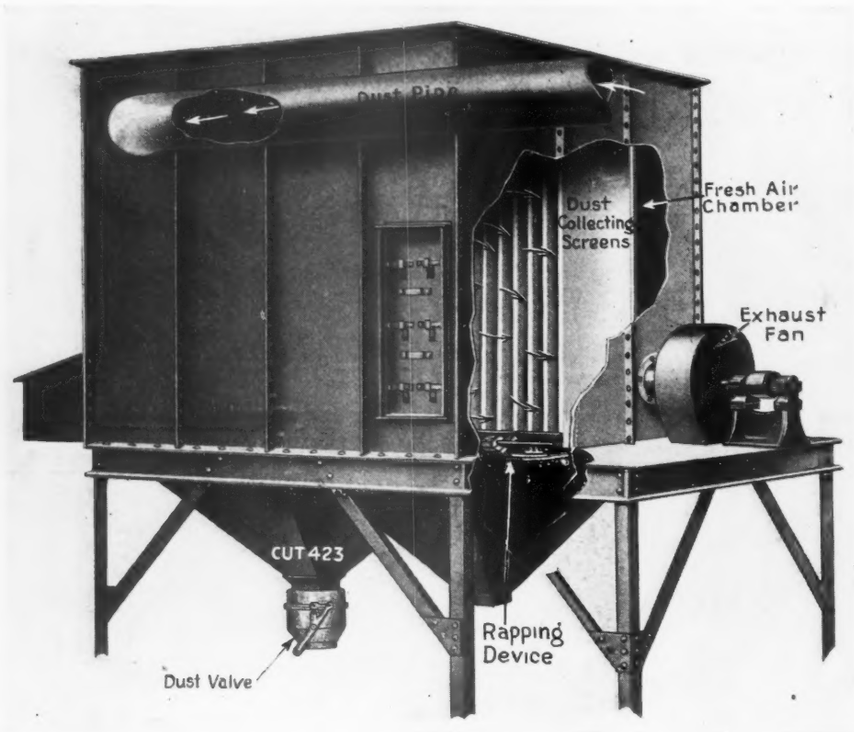
The cement industry first recognized the value of dust arresters in 1917. The first installation by one of the large companies has been followed by additional units until all their plants have been equipped. In the packhouses and bag houses of a cement plant, the dust is either the finest and therefore the best portland cement, or it is coal dust from the pulverizing mill, or it is the dust from the raw material mills. Usually, it is of a cutting or abrasive nature. It is possibly injurious to the employees and is hard on belts, bearings and machinery, and unless effective methods of collection are employed, the natural life of such machinery and equipment is materially shortened.

Saving in Lubricants

Every cement plant, every lime plant, every plant producing gypsum, magnesite, etc. uses immense quantities of lubricating oil and greases. Due to the dust conditions and the high speed of some of the equipment, the lubricating oil requirements of the average cement plant are very large. This can be materially cut down by eliminating the source of the dust. A dust arrester is as necessary in every pack and bag house as is any of the machinery or equipment that can be found there.

Description of Dust Collector

The principle under which the Sly dust arrester operates is simple, yet very efficient. The major requirements of a positive dust arrester or dust-collection system are simplicity of construction, and efficiency of operation. Since most dusts are of an abrasive nature, mechanically moving parts must be eliminated as much as possible. The operation should be fool-proof in that when the power is turned on, the dust is taken away and collected automatically.



Showing the construction of the dust collector

Right at the source is the place where the dust should be taken away. The more the dust is allowed to spread, the more air must be handled and purified. The cost of installation and operation of a dust-collecting system increases in direct proportion to the volume of air handled.

The dust-laden air is conveyed through pipes by connecting these to an exhaust fan. The fineness and specific gravity of the dust determines the velocity of the air in the dust pipes. A fan of proper size and running at the proper speed will produce the required air velocity. The volume of air needed to exhaust the dust depends upon the size of the machine to be ventilated or the dust hood necessary to catch the dust at its source. This air volume and its required velocity determines the size of the dust pipe. The volume is the basis for dust arrester capacities.

By providing an enlargement in the pipe which may take the form of a round or square box, the air velocity through such an enlargement is reduced and the air loses the power to convey a considerable amount of the dust, especially the larger particles. A settling of dust takes place. If the air current is broken up by a baffle within such a settling chamber, or if centrifugal action is used to throw the larger dust particles out of the air current, the settling action is increased.

The air handled by an exhaust fan through a system of piping is finally discharged back into the atmosphere. It will, however, carry along a certain amount of the fine dust which floats in moving air. To confine and collect this dust, nothing but a positive filter can be used.

A Positive Dust Arrester

Such a dust filter or dust arrester is best equipped with cloth as the filtering medium. The cloth should be fairly open in order not to create too great a back pressure. The threads of the cloth should be fine, but as strong as possible, to make the weave loose and durable and the air should pass through the cloth with only the slightest resistance. The loose fibres on the individual threads, in other words, the nap of the cloth, really makes the air passages so fine that even the smallest particle of dust will be retained.

Another factor of utmost importance is that the velocity of the air through the cloth be so low that none of the dust will be drawn into the meshes, but will form a very loose and fluffy layer on the surface without obstructing the passage of the air to any great extent. Therefore, the greater the filter area in proportion to the volume of air to be handled, the looser the dust will lie on the cloth screen and the longer this screen will retain its air filtering capacity without the necessity of shaking the dust down.

From the above can be readily seen the many advantages a positive dust arrester has over the older method of allowing the dust to escape and become a nuisance and a detriment to other industries. This is especially true of cement and rock products industries. Here the collected dust has a substantial value and the improvement of working and living conditions is highly commendable. Many old plants have installed such a system and the others will eventually. All new plants consider this problem in the process of construction and the dust collecting system is an integral and necessary factor that is a sign of progress in this large industry.

Cement Products

TRADE MARK APPLIED FOR WITH U.S. PATENT OFFICE

The Crowning Year in Cement Products

Concrete Block and Brick Triumph Over Competitors in Every Test

WITHOUT reasonable doubt the year now drawing to a close has exceeded all previous annual periods in respect to the output of every important cement product with the exception of drain tile. While preliminary estimates seem to indicate greatest percentage gains in the volume of cast building stone and concrete block, enormous increases are also noted in the case of concrete building tile, roofing tile, sewer pipe and portland cement stucco.

Last spring the question was asked editorially in *Cement and Engineering News* whether 1923, with its enormous increases in cement products production, was a "peak period" or merely a "starter." Now, as 1924 draws to a close, we can answer the question positively, for the industry has once more beaten most of its past records to an extent which leaves no interested person in doubt. Assumed "saturation points" in our markets have been reached and passed and today the industry finds demands for its products stronger than ever.

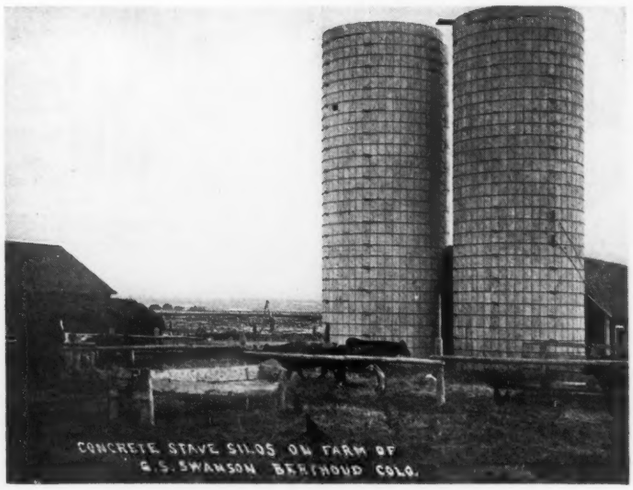
Fire demonstration of a concrete masonry test house at Los Angeles, Calif., November 1, 1924

Building Products Lead

In a number of markets, cement building products — block, structural tile, brick, roofing tile and cast stone have shown greater percentage gains than any competing standard building product of any description. This year, for the first time, concrete block prices have been quoted in the Department of Commerce monthly circulars to the press. In 1924, for the first time, the wall volume constructed with concrete masonry units exceeds the latest available estimates for clay common brick. After unquestioned supremacy in the masonry field for some five thousand years, according to its claims, the clay industry finds itself today running neck to neck with the manufacturers of cement products who five years ago were leading an impoverished existence, producing only about one-tenth of their present output.

In 1920 it was estimated that the American public spent about $12,000,000 for concrete blocks. In 1924, the figure may likely exceed $80,000,000. Where in 1920 there were produced in block and structural tile the equivalent of 50,000,000 8x8x16-in. block, the 1924 output has already been estimated by the Portland Cement Association as equivalent to not less than 462,000,000 8x8x16-in. block, which is the standard unit for statistical purposes. From an average of about 8500 block an-

Four of the four hundred silo coal pockets erected by a Camden, Ohio, firm in 1924



More stave silos were built in 1924 of cement than of any other material

nually per manufacturer in 1920, the number has increased to about 77,000 annually per manufacturer in 1924, the total number of manufacturers remaining fairly constant during this period, at about 6000.

Still Chance to Speed Up Production

Last year it was found that while the number of manufacturers of concrete building materials had not increased, both capital and capacity gained steadily. It was also reliably estimated that around 80% of the products came from 20% of the factories—a balance which has not changed a great deal during the present year.

Taking this information as a basis, and assuming 200 working days per year as a reasonable average, it is plain that the average production per day per factory is only about 385 block, while the average daily production of the larger 20% of the factories would run about 1540 block and for the smaller 80% about 96 block.

While these figures represent encouraging gains over the average daily production of slightly over 40 block per plant in 1920, it is still quite evident that mechanical capacity of the plants is still far in excess of output. After making due allowance for numerous factors it appears likely that not over 60% of the actual capacity of the block machines has been reached, although, of course, in many plants other mechanical limitations of one kind or another undoubtedly prevent output from reaching 100% of machine capacity. The figures suggest, however, that further study of aggregate and product handling equipment, and possibly of labor and other factors may do much toward putting plant capacity more nearly in line with machine capacity.

Cinder Blocks Increase

Cinder aggregate concrete block and building tile have registered a big increase during 1924. From 50,000,000 units produced in 1923, they have jumped to something over 65,000,000 in 1924. For every three cinder concrete block used in 1923, four were delivered in 1924, and with several large new plants just going into production, 1925 bids fair to greatly exceed the present year.

Cinder concrete block have demonstrated their adaptability under a wide range of conditions and for many different uses, and during 1924 gave hollow clay tile the first real taste of competition for use in partition walls. Likewise, 1924 saw the first comprehensive tests on the use of cinder concrete block for floor construction and for the fireproofing of steel building frames, in both of which fields more will be heard about this product in 1925.

Concrete Brick

Competitors have found the inroads of concrete brick a bitter pill. In spite of many artful inventions constantly brought out to delay the progress of this product

A minor part of the half-million block stockpile of a concrete products company at Camden, N. J., probably the largest in the history of the cement products industry (March, 1924)

Machine-made concrete sewer pipe made remarkable progress in 1924. Here is a yard of well-cured pipe ready for installation in the streets of one of our southern cities

by prejudicing architects, building commissioners and others against it, the concrete brick business has more than held its own in 1924. Although forced to fight for almost every order taken, concrete brick salesmen have been backed by the most convincing technical evidence, and concrete common brick have been admitted in New York City and other important centers on the same basis as clay, structures built with them receiving the same fire rate.

Clay common brick interests, to bolster up their competitive battle with concrete, secured a general decrease in freight rates some months ago, a plain case of discrimination against concrete brick, which not only were left taking a higher rate in many cases, but their greater weight served also to increase the spread between clay and concrete brick tariffs. As the year draws to a close a number of state railroad commissions have either placed concrete units on the same low basis or have before them the matter of taking such action.

The best estimates obtainable place the number of concrete common face brick manufactured in 1923 at 190,000,000 and while no later figures are available, the 1924 production probably is not under 200,000,000. It is the general expectation in the industry to make concrete common and face brick available in every market where they can be offered at a saving to the public.

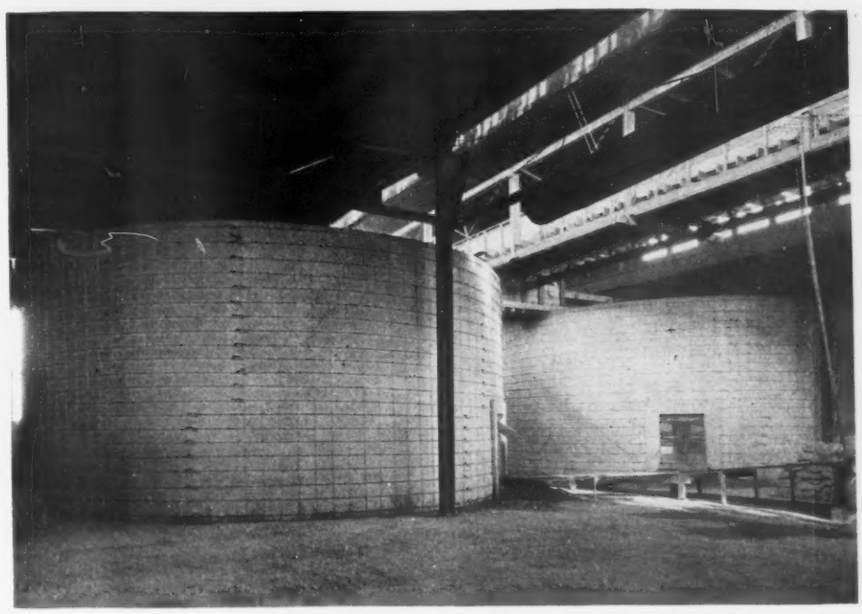
Technical Achievements

Concrete masonry units recently have been subjected to most severe laboratory fire exposure and probably the most exhaustive study of fire-resisting ability yet made on any wall material. The results of this work are being made public in a complete report prepared by the Underwriters' Laboratories and concurred in by the Underwriters' fire council, composed of 40 of the leading fire prevention and insurance experts in America. The conclusions are highly favorable to the materials investigated—concrete block and building tile—and provide insurance rating bureaus with the facts on which to base more equitable insurance rates on concrete masonry construction. Members of the American Concrete Institute, Concrete Products Association and Portland Cement Association as well as others who, as individuals, contributed to the cost of the tests, are about to receive copies of the complete official report issued by the Underwriters' Laboratories.

Comparative tests on the fire behavior of concrete and clay brick masonry, made at the Bureau of Standards at the expense of the clay brick manufacturers, led to a report published during the year, indicating that the concrete brick behaved fully as well as similar clay brick, in all respects. As a result, clay promoters are apparently making no use of the report.

The system of quality control in concrete products manufacture, as advocated by the Portland Cement Association, is being followed in whole or in part by numerous plants, and it is safe to predict that the economies resulting from this method will bring it into general use as rapidly as it can be explained and demonstrated.

Concrete masonry materials will break several records in addition to the general production figures for 1924. The year just closing produced the largest single plant output ever known in the industry—3,500,000 cinder concrete block manufactured by the Crozier-Straub plant in Brooklyn, N. Y. It also found the industry for the first time with about 30 factories all producing 1,000,000 or more block per annum. The year 1924 also carries away honors for the largest single stock pile anywhere, at the beginning of any season—541,000 8x8x16-in. block. Likewise it is thought that a record for size has been made with a number of single orders, the largest about 400,000 units. Concrete masonry units are now being offered in active competition in 45 of the 50 largest cities in the United States.



Several hundred cement stave tanks installed for various industrial purposes helped to swell the year's output

Roofing Tile

Although no general census has yet been taken in the concrete roofing tile field, the number of substantial manufacturers has been increasing, many large city markets being covered for the first time during 1924. In a few cities the spirited campaigns conducted by the concrete tile manufacturers have resulted not only in greatly increasing their own sales but in attracting public attention to both concrete and clay tile as materials greatly to be preferred to other available roofings. The large range of colors and shades in which concrete tile are now offered has increased their popularity. French type tile still furnish the greater part of the output although the Spanish type is rapidly gaining in favor. Shingle type tile have a negligible output as yet with little apparent demand.

Concrete Pipe, Conduit and Similar Materials

During the past year or two reinforced concrete sewer pipe has been admitted in practically all cities of any consequence so that its use now constitutes standard practice throughout the United States and Canada. This refers, of course, to pipe made in sizes from 24 to 108 in.

Plain concrete sewer pipe, manufactured by machine, commonly in sizes up to 24 in., is not used as universally, but has made more progress in 1924 than in the previous three years. This is true with regard both to the tonnage laid and the number of new markets opened. While the Pacific Coast states constituted the stronghold for this class of concrete pipe until recently, many well financed and well operated factories are now making excellent plain sewer pipe in the East, South and Middle West. While competition is naturally severe, challenging the clay products industry in a field it has long dominated, the stability of these concrete manufacturers and the excellence of their product can be relied on to attract public favor to an increasing extent.

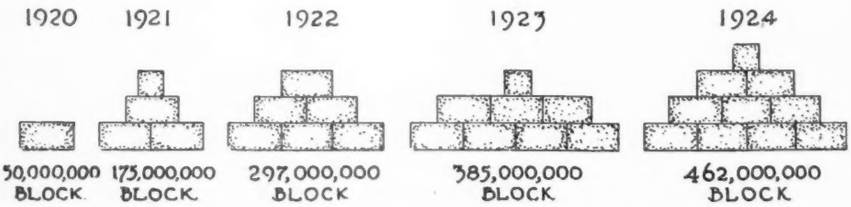
Concrete drain tile, the only cement product of any importance to show stagnation in 1924, owes its difficulties in no

way to competition, being affected almost entirely by the discouragement of the farmers in sections requiring extensive drainage. There is a general feeling in agricultural circles that farm products bring too low a return and that drainage will put more acres in cultivation and produce more crops with depressing effect on prices. Within a year or two we may expect drainage to resume its rightful place in the list of expenditures to extend agriculture.

Concrete conduits, carrying the underground distribution systems for electric power and telephone lines, have come into great popularity in New York, Chicago and a number of other large cities. While a limited quantity of precast concrete conduit material has been successfully manufactured and used for a number of years, the commercial opportunities for pushing this product have only come to full realization during the past year, with the successful employment of a new and improved type of machinery.

Manholes and Catch Basins

During recent months curved interlocking concrete block have replaced thousands of brick for the construction of manholes and catch basins. Concrete masonry is employed in manhole work at a cost for materials and labor running little more than half the usual cost for brick construction. During 1924, more than 1,500,000 concrete block were used for catch basins alone, although a large part of the work is still done with brick.



Progress of the concrete block industry by year, from 1920 to 1924

Cement Staves

The growing importance of the concrete stave not only for the erection of silos, but for tanks of all kinds was an outstanding development of the year. One of the more active stave builders has erected over 400 circular stave bins this year for the handling and storage of coal alone. Silo business has shown decided gains in almost all localities except Iowa, and the encouraging outlook has led the manufacturers, after several years of work in the National Concrete Stave Silo Association, to form the National Silo Research Institute, adequately financed for a thorough campaign of research and publicity, with the best available talent supplied to direct the work. During 1924 approximately 200 concerns were actively engaged in manufacturing concrete staves and erecting silos and tanks. According to best available information, one of these concerns delivered more silos in 1924 than were made by any other manufacturer of any type in the United States or Canada.

A Great Start for 1925

Space limitations prevent even bare mention of most of the 366 precast cement products which are used throughout the country, but many manufacturers of such specialties as laundry trays, burial vaults, septic tanks, posts, poles, ornamental ware, floor tile and concrete lumber report an unusually good year. There have been very few business failures in the cement products industry during the year. Over 250 new factories have been built, including major rehabilitation of old plants. A number of important expansions are authorized or actually under way.

During 1924 some 20 concrete masonry houses were built as the centerpiece of better homes demonstrations in important cities. In the latter half of the year over 20,000 copies of the concrete house plan book were purchased by the public from the Portland Cement Association. Advertising and educational work have been carried on by manufacturers and trade press to an unprecedented extent, while improvements in manufacturing processes have removed many production difficulties.

Barring the possibility of general business depression, which appears to everyone as very remote, we may expect a prosperous year ahead in the field of various cement products. The greater number of these products are very adaptable to the changing character of building markets, assuring a good volume of business under almost any circumstances which are likely to be encountered.

Cement Products Plant in Milwaukee Burns

THE plant of the Christoffel Concrete Products Co., Milwaukee, was destroyed by fire recently. Officials of the concern say that it was impossible to sound an alarm as no telephone connection could be made, and by the time wire service was restored, the building was a mass of debris. The building was a two-story frame structure, used in the manufacture of concrete blocks, and was about 40x200 ft. The loss is estimated at about $20,000.—*Milwaukee (Wis.) Sentinel.*

Cinder Block Plant Established in Kansas City

THE Crowell Fireproof Block Co. has been built up at 43rd street and Mill Creek parkway, Kansas City, Mo., to build cinder blocks for some eight states in the Middle West. Paul M. Fogel is president; H. H. Crowell, vice-president and manager, and E. W. Arrasmith, director of sales. They get cinders for practically nothing. The railways company ships them out to the plant from the power house at Second street and Grand avenue. They are dumped from the car tracks into a hopper, which sifts and crushes them. Concrete is mixed with the cinder particles, and the mass is shoveled into presses, which form blocks in three sizes, 4x8x16 in., 8x8x16 in. and 8x12x16 in., and sell at the plant at 11 cents, 18 cents and 20 cents respectively.

Four presses are in continuous operation at the plant. The blocks are lifted from the presses, shelved for a few days inside the plant, then carted outside to the yards, where they stand from three to four weeks.

Nails can be driven into cinder blocks. Frames and trims may be nailed directly to cinder block units. The blocks do not crack and the nails hold as in wood. They are light, 30 lb. for an 8x8x16 in. unit as against 50 lb. for an average unit of other aggregates. They provide excellent bond for stucco, plaster and mortar. Their crushing strength is 800 lb. to the inch, and tests here show their resistance to fire is greater than tile or brick.

Some of the enterprises constructed of cinder blocks here include the Ambassador hotel, J. C. Nichols exhibition home, the postoffice garage at 17th street and Broadway, Westport junior high school, the Phillips apartment, Grand avenue and Brush Creek boulevard, Paul Felix's theater at 18th street and Highland avenue and the home of Dr. France L. Laffoon. These structures are faced with brick or stucco.

The Crowell Co. is capitalized at $300,000. Its present plant has 72,000 sq. ft.—*Kansas City Star.*

How Reinforced Concrete Withstood the Tokio Earthquake

H. M. HADLEY, writing in the Seattle, Wash., *State Architect,* says of the Tokio earthquake on reinforced concrete:

"The performance of reinforced concrete under the test of earthquake and fire can only be classed as highly satisfactory. A survey of reinforced concrete construction in the Tokio building department under the direction of Y. Nagata, chief engineer, resulted as follows:

Undamaged	78.0%
Partially damaged	11.7%
Greatly damaged	7.1%
Partially collapsed	1.9%
Entirely collapsed	1.3%

Wolverine Cement Company Earnings

THIS year has been for the Wolverine Portland Cement Co., Coldwater, Mich., one of the most prosperous in its history. Its prosperity is reflected in the advanced price for its stock on the Detroit stock exchange. The company's dividend record this year is 16 per cent. The total capacity of the company's two plants, one at Coldwater and the other at Quincy, is approximately 2,500 barrels per day. The total production this year will amount to approximately 650,000 barrels. This is a material increase over the production of 1923. The company has at least a 20-year supply of marl available at the Coldwater plant, and about a five-year supply at the Quincy plant.

Both plants, including new additions, are carried on the books at $721,816.61, after depletion and depreciation. It would cost at least $2,000,000 to replace with a plant of the same capacity. The company is in the best of standing with the trade and has no apparent difficulty in obtaining all the business it can conveniently handle. Because of extensive road construction plans and the prosperity predicted, the company ought to do a very satisfactory business for the next few years, at least.

Employment conditions at both plants are said to be highly satisfactory. During the major portion of the year, 225 men are kept steadily employed, 125 being at the local plant, and 100 at the Quincy factory. Although several manufacturing institutions of the country have reduced their scale of wages since the war, this has not been done at the cement plant here, says C. C. Jones, president and general manager.—*Michigan Contractor and Builder.*

No Prohibition on Imports of Portland Cement

Noting that certain newspaper stories left the inference that an import prohibition had been placed on imports of portland cement from some European countries, Rock Products wrote to the Treasury Department and received the following reply which is published in full:

TREASURY DEPARTMENT
Office of the Secretary
WASHINGTON
December 18, 1924.

Editor, Rock Products.

Sir:

The Department is in receipt of your letter of the 1st instant, stating that, in the *New York Times* of November 23, there appeared an item to the effect that an import prohibition has been issued by the United States government, which practically prohibits the import of Portland cement from Denmark and Belgium, and that, on this account, imports of Portland cement from Denmark have ceased. You request to be advised, in the event the article is correct, as to the details of the import prohibition, and what effect it will have upon the importation of Portland cement in general.

I have to advise you that no such import prohibition has been issued or contemplated. Between August, 1923, and September 30, 1924, appraisers of merchandise, acting under instructions from the Treasury Department, withheld their appraisement reports covering cement imported from several countries of Europe, including Belgium and Denmark, pending an investigation as to whether or not the provisions of the Anti-dumping Act of 1921 were being violated with respect to the importation of cement from those countries, that is, whether or not it was being sold at less than the foreign market value, and whether or not a domestic industry was injured by the importation of such cement.

After an extensive investigation and careful consideration of the evidence adduced, the Department reached the conclusion that sales of foreign-made cement at less than its foreign market value and injury to a domestic industry by reason of the importation of such cement had not been satisfactorily established, and on September 30th last it declined to issue a finding of dumping in accordance with Section 201 of the Anti-dumping Law, and instructed Appraisers of Merchandise that appraisement reports covering imported cement need no longer be withheld so far as any question of dumping was concerned.

Accordingly, there is now no restriction imposed by the Department on the importation of foreign cement. It is probable that during the pendency of the matter the uncertainty as to the nature of the Department's decision had a tendency to discourage importations, but, in view of its decision of September 30th above referred to, this condition no longer exists.

Respectfully,
E. W. CAMP,
Director of Customs.

Proposed Duty on Philippine Cement Imports

THE heads of the several government departments of the Philippine Islands have practically decided that the only salvation for their cement plant is to put on a heavy protective duty. It has been tentatively agreed in conference to raise the import levy from $0.16 per 100 kilos to $0.32. Translated into terms of the local markets, the principal imported cement, "Asano," will have to pay a duty of about 1.19 pesos ($0.60) per barrel of a little over 186 pounds. The present price of cement in this market is from 4.6 pesos ($2.30) to 4.8 pesos ($2.40) per barrel. The president of the National Development Co., which manages the Cebu plant, has petitioned the governor general to fix a price of 6.2 pesos ($3.20) so far as purchases for government works are concerned.

The government, according to frequent announcements, is anxious to sell this plant to private interests in pursuance of its policy of getting out of business.—*U. S. Commerce Reports.*

Copy of Aspdin Cement Patent Presented to New York State

SIR EDWIN AIREY, former Mayor of Leeds, England, recently presented to New York State a photographic copy of the original patent granted to Joseph Aspdin by King George IV for the invention of portland cement. Dr. Frank P. Graves, State Commissioner of Education received the gift.—*New York Post.*

Finds Cement Securities Company Violates Anti-Trust Act

PRESS dispatches from Denver, Colo., dated December 13 say that Federal Judge T. Blake Kennedy, sitting in the United States district court, found the Cement Securities Co., operating five subsidiary concerns, guilty of violation of the Sherman anti-trust act and ordered the concern to dispose of its interest in at least two of the co-ordinate organizations.

The decision came down as the result of a suit filed by the United States government in 1922, and the Cement Securities Co. is further enjoined from compiling and distributing freight rates with other cement companies.

The court also ordered the immediate disposal of the organization's interest in the plant operated at Concrete, Colo., and of its interest in either of the plants operated at Trident and Hanover, Mont.

The company's subsidiary organization include the Colorado, the Union, the Three Forks, the United States and Nebraska Portland Cement companies, according to the papers from which the above is taken.

Built 8,620 Miles of Federal-Aid Roads June, 1923-June, 1924

PROGRESS in the construction of federal-aid roads resulted in the completion of 8,620 miles during the fiscal year ending June 30, 1924, according to the annual report of the Bureau of Public Roads of the United States Department of Agriculture. This brings the total of roads completed with Federal aid since 1916 to 35,157 miles. Work was in progress at the end of the fiscal year on 15,350 miles and these roads were reported as 56% complete.

As in previous years, the mileage of gravel roads completed exceeded the mileage of any other type of construction, the year's total including 3,353.8 miles. Other types were completed, as follows: Graded and drained, 1,604.8 miles; sand-clay 888.2 miles; water-bound macadam, 106.7 miles; bituminous macadam, 566.6 miles; bituminous concrete, 252.1 miles; concrete, 1,667.9 miles; brick, 169.4 miles. Bridges more than 20 feet in span completed during the year aggregated in length 10.8 miles.

Sand-Lime Brick Gain 100%

A recent report from the Common Brick Manufacturers' Association contained a statement which merits the attention of the brick manufacturers in this country. It states that the sand-lime brick production in 1923 was 187,025,000 valued at $2,176,000. This may be compared with 93,000,000 sand-lime brick produced in 1921 with a value of $1,214,000. The increase in sand-lime brick production in the two years from 1921 to 1923 was over 100%, but the average price per thousand has decreased from $13.06 to $11.63 in 1923.—*Brick and Clay Record.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:			1.30 per net ton all sizes			
Buffalo, N. Y.						
Chaumont, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Columbia, Ill.	1.10	1.20	1.35	1.35	1.20	1.20
Eastern Pennsylvania	1.35	1.35	1.45	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Northern New Jersey	.....	.....	1.60	.....	.....	.....
Prospect, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Walford, Penn.	.....	1.35	.....	1.50	1.60	1.60
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alton, Ill.	1.50	.....	1.50	.....	.....	.....
Bloomville, Middlepoint. Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.10	1.00	1.00
Buffalo, Iowa	1.10	.....	1.25	1.05	1.10	1.10
Chicago, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Dundas, Ont.	.75	1.00	1.00	.90	.90	.90
Greencastle, Ind.	1.25	1.25	1.15	1.05	1.05	1.05
Lannon, Wis.	.80	1.10	1.10	.90	.90	.90
Linwood, Iowa	1.00	1.25	1.25	1.05	1.05	1.15
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
St. Vincent de Paul, P. Q.	.90	1.25@1.45	1.00	.90	.90	.....
Stone City, Iowa	.75	.....	1.20†	1.10	1.05	.....
Waukesha, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Wisconsin Points	.50@1.50	.....	1.10	1.00	1.00	.....
Youngstown, Ohio	.....	.....	.....	1.50	1.60	1.60
SOUTHERN:						
Alderson, W. Va.	.60	1.60	1.60	1.50	1.40	.....
Bridgeport and Chico, Texas	100a	1.35b	1.35b	1.25	1.20	1.15
Cartersville, Ga.	1.65	1.65	1.65	1.35	1.35	.....
El Paso, Texas	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.60	1.60	1.60	1.50	1.40	.....
WESTERN:						
Atchison, Kans.	.50	2.00	2.00	2.00	2.00	1.60‖@1.80
Blue Spr'gs & Wymore, Neb.	.20	1.45	1.45	1.35@1.40	1.25@1.30	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Kansas City, Mo.	1.00	1.65	1.65	1.65	1.65	1.65

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.60	1.35	1.15	1.00	.....
Cypress, Ill.	1.00@1.10	.....	.....	.....	.....	.....
Duluth, Minn.	1.00	2.25	1.75	1.50	1.30	1.30
Dwight, Calif.	1.75	1.75	1.75	1.75	1.75	.....
Eastern Maryland	1.10	1.75	1.70	1.60	1.50	1.50
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.75	1.70	1.60	1.50	1.50
Minneapolis, Minn.	1.25	.....	2.25	2.00	1.75	.....
Northern New Jersey	1.70	2.20	2.00	1.60	1.60	.....
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	.....
San Diego, Calif.	.50@.75	1.80@1.90	1.60@1.80	1.35@1.55	1.35@1.55	1.25@1.45
Springfield, N. J.	2.00	2.10	2.10	1.70	1.60	1.60
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	1.10

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	.....
Eastern Penn.—Sandstone	1.25	1.65	1.60	1.40	1.40	1.25
Eastern Penn.—Quartzite	1.20	1.35	1.20	1.20	1.20	1.20
Graysville, Ga.—Granite	1.00	.....	1.00	.90	.....	.....
Lithonia, Ga.—Granite	.75(c)	2.00	1.75	1.25	1.25	.....
Lohrville, Wis.	1.65	1.65@1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	2.00@2.25	1.25@2.00
Northern New Jersey (Basalt)	150	2.00	1.80	1.40	1.40	.....
Richmond, Calif. (Basalt)	.75*	.....	1.50*	1.50*	1.50*	.....

*Cubic yd. †1 in. and less. ‖Rip rap per ton; (a) dust in; (b) dust out; (c) sand.

Agricultural Limestone

(Pulverized)

Alton, Ill. — Analysis, 98% $CaCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C. — Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Branchton, Penn. — 100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Bridgeport and Chico, Texas—100% thru 100 mesh, bags	10.00
Cartersville, Ga. — Analysis, 56% $CaCO_3$, 42% $MgCO_3$; pulverized	2.25
50% thru 50 mesh	1.50
Chaumont, N. Y. — Pulverized limestone, bags, 4.00; bulk	2.50
Colton, Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Dundas, Ont., Can.—Analysis, 53.80% $CaCO_3$, 43.31% $MgCO_3$; 35% thru 100 mesh, 50% thru 50 mesh, 100% thru 10 mesh; bags, 4.75; bulk	3.00
Hillsville, Penn. — Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 75% thru 100 mesh; sacks, $5.00; bulk	3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va. — Analysis, 90% $CaCO_3$, 2% $MgCO_3$; 42.5% thru 100 mesh, 11.3% thru 80, 20.2% thru 60, 22.8% thru 40, 3.2% thru 20 and under or 75% thru 40 mesh; pulverized, per ton	2.00
Mayville Wis.—59.8% thru 60 mesh	2.35
Mountville, Va.—Analysis 76.60% $CaCO_3$, 22.83% $MgCO_3$; 50% thru 100 mesh, 100% thru 20 mesh—125-lb. hemp bags	5.00
Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Piqua, Ohio—Total neutralizing power 95.3%; 100% thru 10, 60% thru 50; 50% thru 100	2.10@ 2.25
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.00; bulk	3.50
100% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rockdale, Mass. — Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk	3.25
West Stockbridge, Mass. — Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 100 mesh	1.50
Alton, Ill.—Analysis 98% $CACO_3$; 50% thru 4 mesh	3.50
Bedford, Ind.—Analysis, 98½% $CACO_3$, ½% $MgCO_3$; 90% thru 10 mesh	1.50
Bettendorf, Iowa — 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Blackwater, Mo.—98% $CaCO_3$; 100% thru 8 mesh	1.00
Bridgeport and Chico, Texas — 50% thru 50 mesh; 90% thru 4 mesh	1.50
50% thru 4 mesh	1.25
Cape Girardeau, Mo.—Analysis, 93.5% $CaCO_3$, 3.5% $MgCO_3$; 50% thru 100 mesh	1.50

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	1.25
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 100% thru 4 mesh; 85% thru 10 mesh; 53% thru 50 mesh; 40% thru 100 mesh bulk	2.60
32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	2.25
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 52% $CaCO_3$, 44% $MgCO_3$; meal, 100% thru 4 mesh, 35% thru 100 mesh	.75@ 1.50
Milltown, Ind.—Analysis, 94.41% $CACO_3$, 2.95% $MgCO_3$; 30.8% thru 100 mesh .38% thru 50 mesh	1.45@ 1.60
Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$—50% thru 100 mesh; 50% thru 4 mesh	1.50
Pixley, Mo.—Analysis, 96% $CACO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton.

Glass Sand:	
Berkeley Springs, W. Va.	2.25@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Cheshire, Mass: 6.00 to 7.00 per ton; bbl.	2.50
Columbus, Ohio	1.25@ 1.50
Estill Springs and Sewanee, Tenn.	1.50
Grays Summit and Klondike, Mo.	2.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Ohlton, Ohio	2.50
Oceanside, Calif.	3.00@ 3.40
Pacific, Mo.	2.25@ 3.00
Pittsburgh, Penn.—Dry	4.00
Damp	3.00
Red Wing, Minn.: Bank run	1.50
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.25
San Francisco, Calif.	3.00@ 3.50
St. Louis, Mo.	1.50@ 3.00
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.25
Zanesville, Ohio	2.50
Miscellaneous Sands:	
Aetna, Ind.: Core, Box cars, net, .35; open-top cars	.30
Albany, N. Y.: Molding fine, brass molding	3.00
Molding coarse	2.75
Sand blast	4.50
Arenzville, Ill.: Core	1.00
Molding fine	1.50@ 1.75
Brass molding	2.00
Beach City, Ohio: Fine core, washed and screened	1.50
Furnace bottom; steel molding (fine and coarse) washed and screened	2.00
Traction	1.75
Cheshire, Mass.—Furnace lining, molding fine and coarse	5.00
Sand blast	5.00@ 8.00
Stone sawing	6.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, f. o. b. producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Buffalo, N. Y.	1.10	.95			.85	
Erie, Penn.		1.00		1.25	1.50	
Farmingdale, N. J.	.58	.48	.85		1.10	
Leeds Jct., Maine		.50	1.75		1.35	1.25
Montoursville, Penn.	1.00	1.10	1.00	1.00	1.00	.90
Northern New Jersey	.40@ .50	.40@ .50		1.25	1.25	1.25
Pittsburgh, Penn., and vicinity		1.25	1.25	.85	.85	.85
Shining Point, Penn.			1.00	1.00	1.00	1.00
Washington, D. C.—Rewashed, river	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Attica, Ind.	.75	.75	.75	.75	.75	75
Barton, Wis.		.22@ .40	.20@ .40	.20@ .40	.32@ .40	
Columbus, Ohio	.75	.75@1.00	.75@1.00	.75@1.00	.75@1.00	.75
Covington, Ind.	.75	.75	.75	.75	.75	.75
Des Moines, Iowa	.50	.30	1.50	1.50	1.50	1.50
Eau Claire, Wis.	.60@1.00	.40@ .50	.85@1.25			.85@ .95
Elkhart Lake, Wis.	.60	.50	.60	.60	.60	.60
Ft. Dodge, Iowa	1.00		2.05	2.05	2.05	
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Rapids, Mich.		.50		.80	.70	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Iowa	.45@ .55	.45@ .55	1.35@1.45	1.45@1.55	1.40@1.50	1.35@1.45
Mankato, Minn.		.50	1.25		1.25	
Milwaukee, Wis.	1.01	1.01	1.21	1.21	1.21	1.21
Minneapolis, Minn.*	.65	2.50†	2.00§		2.00	1.75
Northern New Jersey	.45@ .50	.45@ .50		1.25	1.25	
Palestine, Ill.	.75	.75	.75	.75	.75	.75
St. Louis, Mo., f. o. b. cars	1.18	1.45	1.65§	1.45		1.45§
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
Summit Grove, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.60	.90	.90	.90	.85
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.	.55	.55	.75	.75	.75	.75
Winona, Minn.	.40	.40	1.25	1.10	1.00	1.00
Yorkville, Sheridan, Oregon, Moronts, Ill.			Average .40@.60			
Zanesville, Ohio		.60	.60	.60	.90	
SOUTHERN:						
Brookhaven, Miss., Roseland La.	1.75*	.70	2.25	1.50	1.25	
Charleston, W. Va.	all sand 1.37 f.o.b. cars		all gravel 1.47 f.o.b. cars			
Chehaw, Ala.	1.24	1.24		1.90	1.90	1.90
Estill Sp'gs & Sewanee, Tenn.	1.00	.90	1.00	1.00		.85
Knoxville, Tenn.	1.00	1.20	1.20	1.20	1.20	1.20
Macon, Ga.	.50	.50		.55	.60	
New Martinsville, W. Va.	1.00	.90		1.30		.90
Smithville, Texas	1.00	1.00	1.00	1.00	1.00	1.00
WESTERN:						
Baldwin Park, Calif.		.25@ .35			.50@ .75	
Crushed rock	.90@1.10	.60@ .90	.60@ .90	.60@ .90	.60@ .90	
Kansas City, Mo.			Kaw river sand .75 per ton f.o.b. plants			
Los Angeles, Calif.		.40	.50	.65	.60	.60
Pueblo, Colo.	1.10	.90*		1.50*		1.65*
San Diego, Calif.	.50	.50	1.20	1.20	1.00	1.00
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*		1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Brookhaven, Miss., Rosel'd, La.			Road gravel, ballast gravel .60 a ton			
Chehaw, Ala.	.90@1.00					
Des Moines, Iowa			Washed, .50; unwashed, .40 (not screened)			
Dudley, Ky.‡	1.05	1.05		.95		
East Hartford, Conn.			Sand, .65 per cu. yd.			
Elkhart Lake, Wis.	.50					
Gainesville, Texas		.95				.55
Grand Rapids, Mich.				.55		
Hamilton, Ohio					.70	
Hersey, Mich.				.55		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas						.55
Macon, Ga.	.35					
Mankato, Minn.			Pit run gravel, .60			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Montezuma, Ind.						.60
St. Louis, Mo.			Mine run gravel 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Smithville, Texas	.50	.50	.50	.50	.50	.50
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waukesha, Wis.	.60	.60	.60	.60	.60	.60
Winona, Minn.				.60	.60	.60
York, Penn.	1.10	1.00				
Zanesville, Ohio		.60				

*Cubic yd.; †roofing gravel; §⅝ in. and less; ‡crushed silica; ‖2½ in. and less; (a) ¾ in. and less; (b) river run.

Miscellaneous Sands

(Continued from preceding page)

Columbus, Ohio:		
Core	.30@	.50
Furnace lining, molding coarse	2.00@	2.25
Molding fine	2.50@	2.75
Sand blast	4.00@	4.50
Stone sawing		1.50
Traction	.50@	.75
Brass molding	2.50@	3.00
Dresden, Ohio:		
Core	1.25@	1.50
Molding fine	1.50@	1.75
Molding coarse		1.50
Traction		1.25
Brass molding		1.75
Dunbar, Penn.:		
Traction (damp)		2.00
Eau Claire, Wis.:		
Sand blast	3.00@	3.25
Elco, Ill.:		
Ground silica per ton in carloads	20.00@	31.00
Estill Springs and Sewanee, Tenn:		
Molding fine and coarse, brass molding		1.25
Roofing sand, sand blast, traction		1.50
Franklin, Penn.:		
Core		2.00
Molding coarse and fine		1.75
Grays Summit, Mo.:		
Molding fine	1.75@	2.00
Joliet, Ill.:		
No. 2 molding sand; also loam for luting purposes and open-hearth work	.65@	.85
Klondike, Mo.:		
Molding fine	1.75@	2.00
Mapleton Depot, Penn.:		
Molding fine and coarse		2.00
Massillon, Ohio:		
Molding fine, coarse, furnace lining core and traction		2.50
Montoursville, Penn.:		
Core	1.25@	1.35
Traction	1.00@	1.10
Brass molding		1.50
New Lexington, Ohio:		
Molding fine		2.75
Molding coarse		2.25
Ohlton, Ohio:		
Core, furnace lining, molding fine and coarse, all green	1.75@	1.90
Roofing sand, sand blast, stone sawing, traction, all green		1.75
Add 50c a ton for green sand dried.		
Oceanside, Calif.:		
Roofing sand (stucco)	3.00@	3.40
Ottawa, Ill.:		
Crude silica sand	.75@	.85
Core, bags, 2.50; bulk		1.75
Sand blast		5.00
Stone sawing		1.75
Pacific, Mo.:		
Core, furnace lining	1.00@	1.25
Molding fine	.90@	1.00
Stone sawing	1.00@	1.75
Molding coarse	.85@	1.00
Red Wing, Minn.:		
Core, furnace lining, stone sawing		1.50
Molding fine and coarse, traction		1.25
Sand blast		3.50
Filter sand		3.75
Ridgway, Penn.:		
Core		2.00
Furnace lining, molding fine, molding coarse		1.25
Traction		2.25
Round Top, Md.:		
Core		1.60
Traction		1.75
Roofing sand		2.25
St. Louis, Mo.:		
Core	1.00@	1.75
Furnace lining		1.50
Molding fine	1.50@	2.50
Molding coarse	1.25@	1.75
Roofing sand		1.75
Sand blast	3.50@	4.50
Stone sawing	1.25@	2.25
Traction		1.25

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	3.00	1.00	2.25	1.25	1.25	1.15	1.15
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00	2.50*	1.25	.....	.....	.....
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05	1.45	.....	1.45	.....	1.45	.....
Jackson, Ohio	.....	1.05	.....	1.30	1.05	1.30	.....
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	.....	1.55	.....	1.55	1.55	1.55	.....
Ensley and Alabama City, Ala.	2.05	.80	1.25	1.15	.90	.90	.80
Longdale, Goshen, Glen Wilton, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

*Clean.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.	.....	.....	12.00	.....	.....	.....	.....	2.20
Buffalo, N. Y.	.....	.....	.....	12.00	.....	.....	.....	.....
Lime Ridge, Penn.	.....	.....	.....	.....	.....	.....	5.00a	.....
Williamsport, Penn.	.....	.....	10.00	.....	.....	.....	6.00	.....
York, Penn.	.....	10.50	10.50	11.50	.....	.....	8.50	1.65i
CENTRAL:								
Cold Springs, Ohio	.....	9.00	9.00	.....	9.00	11.00	.....	.....
Delaware, Ohio	12.50	9.00	8.50	10.00	.....	.....	9.00	1.50
Gibsonburg, Ohio	12.50	.....	.....	.....	9.00	11.00	.....	.....
Huntington, Ind.	12.50	9.50	9.50	.....	9.00	.....	8.50	1.50c
Luckey, Ohio (f)	12.50	.....	.....	.....	.....	.....	.....	.....
Marblehead, Ohio	.....	9.50	9.50	.....	.....	.....	8.50	1.50c
Marion, Ohio	.....	9.50	9.50	.....	.....	.....	8.50	1.70j
Mitchell, Ind.	.....	12.00	12.00	12.00	11.00	.....	10.00	1.70e
Tiffin, Ohio	.....	.....	.....	.....	9.00	.....	.....	.....
White Rock, Ohio	12.50	.....	.....	.....	9.00	11.00	.....	.....
Woodville, Ohio	12.50†	9.00†	8.50†	.....	9.00	10.50	8.00	1.60
SOUTHERN:								
Erin, Tenn.	.....	.....	.....	.....	.....	.....	8.50	1.40*
El Paso, Texas	.....	.....	.....	.....	.....	.....	9.00	.....
Graystone & Wilmay, Ala.	12.50	11.00	.....	11.00	.....	.....	8.50	1.50
Karo, Va.	.....	10.50	9.00	.....	.....	.....	7.00g	1.65h
Knoxville, Tenn.	12.50	11.00	.....	11.00	.....	1.35	8.50	1.50
Varnons, Ala. (f)	11.00	11.00	.....	.....	9.50	.....	8.50	15.00
Zuber an d Ocala, Fla.	14.00	12.00	10.00	14.00	.....	.....	12.00	1.70
WESTERN:								
Kirtland, N. M.	.....	.....	.....	.....	.....	.....	15.00	.....
San Francisco, Calif.	22.00	22.00	15.00	22.00	.....	.....	2.00n	2.50o
Tehachapi, Calif.	.....	.....	.....	.....	.....	.....	13.00	2.00d

*And 1.50; †50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) wood; (e) wood bbl., $2.20 drum in steel; (f) dealers' prices; (g) to 9.50; (h) to 1.75; (i) 200 lb. bbl.; 2.65, 300 lb. bbl.; (j) steel; (l) bags; (m) finishing lime, 2.50 common; (n) common lime; (o) high calcium.

Miscellaneous Sands

(Continued)

Brass molding	2.00@	3.00
San Francisco, Calif.:		
(Washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@	3.50
San Francisco, Calif. (Direct from Pit)		
Furnace lining, molding coarse, sand blast		3.60
Stone sawing, traction		2.30
Tamalco, Ill.:		
Molding coarse		1.50
Brass molding		2.00
Tamms, Ill.:		
Ground silica per ton in carloads	20.00@	31.00
Thayers, Penn.:		
Core		2.00
Molding fine and coarse		1.25
Traction		2.25
Utica, Ill.:		
Core, furnace lining, molding fine and coarse (crude and dried)	.60@	1.25
Roofing sand, stone sawing, brass molding	1.00@	1.25
Sand blast		2.25
Traction		1.00
Utica, Penn.:		
Core, molding fine, brass molding		2.00
Molding coarse	1.50@	1.75
Warwick, Ohio.:		
Core, molding coarse (green) 1.75; (dry) 2.50; traction		2.50
Zanesville, Ohio:		
Sand blast, core, traction		2.50
Furnace lining		2.25
Molding fine and coarse; brass molding	1.50@	1.75

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:		
Crude talc (mine run)	3.00@	4.00
Ground talc (20-50 mesh), bags		10.00
Cubes		55.00
Blanks (per lb.)		.08
Pencils and steel workers' crayons, per gross		1.25
Chatsworth, Ga.:		
Crude (for grinding)		6.00
Ground (150-200 mesh) 200 lb. bags		10.00
Pencils and steel workers crayons	1.25@	2.00
Chester, Vt.:		
Ground (20-70 mesh)	7.00@	8.00
Ground (150-200 mesh)	8.00@	10.00
(Bags extra, returnable)		
E. Granville, Rochester, Johnson, Waterbury, Vt.:		
Ground talc (20-50 mesh) bags	7.00@	10.00
Ground talc (150-200 mesh) bags	10.00@	25.00
Pencils and steel workers' crayons, per gross	.75@	2.00
Emeryville, N. Y.:		
(Double air floated) including bags; 325 mesh (50 lb. paper, 100 & 200 lb. burlap bags)		14.75
Hailesboro, N. Y.:		
Ground (150-200 mesh) bags		18.00
Henry, Va.:		
Crude talc (mine run) per 2000-lb. ton	2.75@	3.50
Ground (150-200 mesh), bags	9.50@	15.00
Joliet, Ill.		
Ground (200 mesh), bags		30.00
Keeler, Calif.:		
(150-200 mesh); carloads, 30 tons or more (bags extra)	20.00@	30.00
Marshall, N. C.:		
Crude	4.00@	8.00
Ground (20-50 mesh), bags extra	6.50@	8.50
Ground (150-200 mesh), bags	8.00@	12.00
Natural Bridge, N. Y.:		
Ground talc (300-325 mesh), 200-lb. bags		13.50
50-lb. bags		14.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@	4.50
Mt. Pleasant, Tenn.—B.P.L. 72%	5.50@	6.00
13% phosphoric acid, 95% thru 100 mesh	5.50@	6.00
75% hand mined	6.50@	6.75
75% (free of fines for furnace use)		6.75
75% max. 5½% I and A	6.50@	7.00
78% max. 4½% I and A		8.00
75/78 B.P.L.	6.50@	8.50
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.		5.50
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.00@	8.00

Ground Rock

(2000 lb.)

Centerville, Tenn.—B.P.L. 65%		7.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.50@	5.00
Mt. Pleasant, Tenn. — B.P.L. 65% 95% thru 100 mesh	6.50@	7.00
Twomey, Tenn.—B.P.L. 65%	7.00@	8.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Clay Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12, 24x14	10.20	10.00	8.10	7.80
22x12	10.80	10.00	8.40	8.75
22x11	10.80	10.50	8.40	8.75
20x12	12.60	10.50	8.70	8.75
20x10, 18x10, 18x9, 18x12	12.60	11.00	8.70	8.75
16x10, 16x9, 16x8, 16x12	12.60	11.00	8.40	8.75
14x10	11.10	11.00	8.10	7.80
14x8	11.10	10.50	8.10	7.80
14x7 to 12x6	9.30	10.50	7.50	7.80
	Mediums	**Mediums**	**Mediums**	**Mediums**
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

Florida Soft Phosphate

(Raw Land Pebble)

Per Ton

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	2.25
70% min. B.P.L., Basis 70%	2.50
72% min. B.P.L., Basis 72%	2.75
75/74% B.P.L., Basis 75%	3.75

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	17.50
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	18.00
Fluorspar, foreign, 85% calcium fluoride, not over 5% silica, c.i.f. Philadelphia, duty paid, per gross ton	19.75

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Barton, Wis., f.o.b. cars		10.50
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		7.00@ 8.00
Easton, Penn.—Evergreen, grit (bulk)		2.00
Royal grit (bulk)		3.00
Haddam, Conn.—Felstone buff	12.00	12.00
Harrisonburg, Va.—Blk marble (crushed, in bags	12.50	12.50
Ingomar, Ohio (in bags)		6.00@20.00
Middlebrook, Mo.—Red		20.00@25.00
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Poultney, Vt., 2000 lb.		6.12
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Cal.—Sized rock for roofing and stucco dashes, CL lots		12.00
Tuckahoe, N. Y.—2000 lb.		8.00@12.00
Wauwatosa, Wis.		16.00@45.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b. cars, granite	4.50@ 6.00	4.50@ 6.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	
Baltimore, Md. (Del. according to quantity)	16.00@17.00	22.00@50.00
Ensley, Ala. ("Slagtex")	12.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Milwaukee, Wis.	14.00@15.00	33.00@75.00
Omaha, Neb.	18.00	30.00@40.00
Philadelphia, Penn.	15.00	21.00
Portland, Ore.	19.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.00@30.00
Puyallup, Wash.	20.00	30.00@90.00
Rapid City, S. D.	18.00	25.00@45.00
Wauwatosa, Wis.	14.00@18.00	30.00@42.00

Sand-Lime Brick

Prices given per 1000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.00
Boston, Mass.	14.00@15.50
Dayton, Ohio	12.50@13.50
Grand Rapids, Mich. (wholesale)	10.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	13.00
Plant City, Fla.	12.00@16.00
Portage, Wis.	15.00
Rochester, N. Y. (delivered)	19.75
Saginaw, Mich.	13.00
San Antonio, Texas	12.50@14.00
Syracuse, N. Y.	18.00

Gray Klinker Brick

El Paso, Texas	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrated, Finishing	per ton Common
Atlanta, Ga.	22.50	14.00
Baltimore, Md.	24.25	17.85
Boston, Mass.	20.50	15.50
Cincinnati, Ohio	16.80	14.30
Chicago, Ill.	20.00	18.00
Dallas, Tex.	20.00	———
Denver, Colo.	24.00	———
Detroit, Mich.	22.00	20.00
Minneapolis, Minn. (white)	25.50	21.00
Montreal, Que.	———	21.00
New York, N. Y.	18.20	13.10
Philadelphia, Penn.	23.00	16.00
St. Louis, Mo.	24.00	20.00
San Francisco, Calif.	22.60	———
Seattle, Wash. (paper sacks)	24.00	———

Portland Cement

Prices per bag and per bbl. without bags net in carload lots.

	Per Bag	Per Bbl.
Albany, N. Y.	———	2.62
Atlanta, Ga.	———	2.35
Boston, Mass.	———	2.53@3.03†
Buffalo, N. Y.	———	2.38@2.88†
Cedar Rapids, Iowa	———	2.38
Cincinnati, Ohio	———	2.37
Cleveland, Ohio	———	2.39
Chicago, Ill.	———	2.10
Columbus, Ohio	———	2.44
Dallas, Texas	.53¾	2.15
Davenport, Iowa	———	2.29
Dayton, Ohio	———	2.48
Denver, Colo.	.63¾	2.55
Detroit, Mich.	———	2.40
Duluth, Minn.	———	2.19
Indianapolis, Ind.	———	2.31
Kansas City, Mo.	———	1.97
Los Angeles, Cal. (less 5c dis.)	.65	2.60
Memphis, Tenn.	———	2.60
Milwaukee, Wis.	———	2.25
Minneapolis, Minn.	———	2.42
Montreal, Canada (sks. 20c ext.)	———	1.90a
New Orleans, La.	———	2.40
New York, N. Y.	———	2.15@2.65†
Peoria, Ill.	———	2.27
Philadelphia, Penn.	———	2.41@2.81†
Phoenix, Ariz.	.82½	3.65
Pittsburgh, Penn.	———	2.19
Portland, Ore.	———	3.05
San Francisco, Cal.	.65¼	2.61*
St. Louis, Mo.	.57½	2.30
St. Paul, Minn.	———	2.42
Seattle, Wash. (10c bbl. dis.)	———	2.65
Toledo, Ohio	———	2.36

NOTE—Add 40c per bbl. for bags.
*5c cash disc 10 days.
†Prices to contractors, including bags.
(a) Less 10c 20 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	———	1.95
Concrete, Wash.	———	2.60
Dallas, Texas	———	2.15
Fordwick, Va.	———	2.05
Hannibal, Mo.	———	2.05
Hudson, N. Y.	———	2.05
Kingsport, Tenn.	———	2.05
Leeds, Ala.	———	1.95
Louisville, Ky.	———	2.45
Northampton, Penn.	———	1.95
Steelton, Minn.	———	2.00
Universal, Penn.	———	1.95

Cement Products

Hawthorne tile, carload lots, f. o. b. plant.

	Cicero, Ill. Per sq.	Ft. Worth, Tex. Per sq.
Silver gray	———	8.00
Red French	9.00	9.00
Green French	11.00	10.00
Red Spanish	12.00	9.00
Green Spanish	14.00	10.00

	Cicero Red	Cicero Green	Ft. Worth Gray	Ft. Worth Red	Ft. Worth Green
Ridges	.25	.35	.25	.25	.30
Hips	.20	.30	.14	.14	.17
Ridge closers	.05	.06	.06	.06	.06
Hip terminals, 2 way	1.25	1.50	1.00*	1.00*	1.25*
Hip starters	.50	.60	.22	.22	.25
Gable finials	1.25	1.50	1.00	1.00	1.25
Gable starters	.20	.30	.14	.14	.16
End bands	.20	.30	———	———	———
Eave closers	.06	.08	.06	.06	.06

*3-way terminals.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Agatite, Texas (a)	———	———	6.00	10.00	10.00	10.50	10.00	———	19.00	———	———	———	———
Akron, N. Y. (a)	3.00	4.00	6.00	10.00	10.00	10.00	20.20	7.00@9.00	27.35	21.00	19.375	20.00	30.00@32.00
Blue Rapids, Kans. (a)	2.50	4.00	6.00	10.00	10.00	10.50	10.00	———	23.15	19.00	19.375	20.00	———
Douglas, Ariz.	———	———	7.00	———	16.50	———	19.50	———	———	15.50	———	———	———
Ft. Dodge, Iowa (a)	2.50	4.00	6.00	10.00	10.00	10.50	15.45	———	22.70	20.00	19.375	20.00	30.00
Grand Rapids, Mich.	2.75*	6.00†	6.00†	9.00‡	10.00‖	10.00‖	———	———	———	———	———	———	———
Gypsum, Ohio (a)	2.75	4.00	6.00	10.00	10.00	10.00	19.25	7.50	26.85	19.00	19.375	20.00	30.00
Hanover, Mont.	———	———	———	11.80	———	———	———	———	———	———	———	———	———
Port Clinton, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	21.00	7.00	30.00	20.00	———	20.00	30.00
Portland, Colo.	———	———	———	10.00	———	———	———	———	———	———	———	———	———
San Francisco, Calif.	———	———	9.85	———	14.40	———	15.40	———	———	———	———	———	———
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	———	———	———	———	28.50	———	35.00

NOTE—Returnable Bags, 10c each; Paper Bags, 1.00 per ton extra (not returnable).
*To 3.25; †to 8.00; ‡to 11.00; ‖to 12; (a) prices are net of bags.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning December 22:

New England Freight Association Docket

7533-(1-R). Cement (common, hydraulic, natural or portland). Hudson Upper, N. Y., to Danville, N. Y., 15½ cents. Reason: To place Hudson Upper on a parity with Hudson, New York.

Central Freight Association Docket

9764. Crushed stone. Carey, Ohio, to Nankin and Polk, Ohio. Present, 14½ cents; proposed, 90 cents per net ton.

9765. Sand and gravel. Evansville, Ind., to Eldorado and Harrisburg, Ill. Present, $1.04 and $2.02 per net ton; proposed, $1.01 per net ton.

9761. Crushed stone. White Sulphur, Ohio, to points in Ohio on the H. V. R. R. Present. Sixth class; proposed (in cents per net ton):

To Hocking Division	Proposed Rate
South Columbus	....
Valley Crossing	....
Groveport	80
Canal Winchester	80
Lockville	80
Carroll	80
Hookers	80
Lancaster Camp Grounds	90
Lancaster	*90
Sugar Grove	90
Rockbridge	90
Enterprise	90
Logan	90
Haydenville	90
Nelsonville	90
Floodwood	90
Hamley Run	90
Beaumont	90
Hocking	90
Armitage	90
Athens	90
To River Division	
Union Furnace	100
Logan	90
New Plymouth	100
Orland	100
Creola	100
McArthur	100
Dundas	100
Oreton	110
Radcliff	110
Hawks	110
Clarion	110
Minerton	110
Alice	110
Vinton	110
Glenns	120
Bidwell	120
Kerrs	120
Mills	120
Gallipolis	120
Kanauga	120
Addison	120
Cheshire	120
Hobson	120
Middleport	120
Pomeroy	*120
Jackson Branch	
Dundas	100
Hamden	100
Wellston	100
Glen Roy	100
Coalton	100
Jackson	100
Snow Fork Branch	
Nelsonville	90
Buchtel	90
Orbiston	*90
Murray City	90
Brush Fork Branch	
Nelsonville	90
Tobs	90
Consol	90
New Pittsburgh	90
Straitsville Branch	
Logan	90
Gore	90
New Straitsville	90

*Present.

9771. Sand and gravel. Merom and Riverton, Ind., to Rinard, Cisne, Gaff and Fairfield, Ill. Present, $1.26 per net ton; proposed, $1.13 per net ton.

9775. Sand, viz., blast, engine, glass, foundry, molding and silica. Conneaut, Ohio, to Olean, N. Y. Present, $3.40 per net ton; proposed, $1.89 per net ton.

Southern Freight Association Docket

17665. Sand and gravel. Carloads, from Collong, S. C., to Rockingham, N. C. Present, $1.09 per net ton (combination); proposed, 99 cents per net ton, based on joint line scale, submitted by carriers to Georgia Public Service Commission for application over trunk lines.

17703. Gravel. Carloads, from Wrens and Graybill, Ga., to Jacksonville, Fla. Present, $2.03 per net ton (Class P); proposed, $1.62 per net ton, same as rate in effect from competitive shipping points.

17711. Sand and gravel. It is proposed to establish rates on sand and gravel, carloads, from Coosada, Oktamulke, Jackson's Lake and Prattville Junction, Ala., to Madison, Fla., and to stations on the South Georgia Ry., the same as applicable from Montgomery, Ala., to apply in lieu of through rate of $2.59 per net ton to Madison, Fla., and Montgomery, Ala., combination to South Georgia Ry. stations.

17735. Granite or stone, rubble or crushed. It is proposed to cancel present rate of $3.04 per ton on granite or stone, rubble or crushed, carloads, from Columbia, S. C., and Rockton (when from Rion), S. C., to Tampa, Fla., permitting lowest combination to apply, which results in rates of, from Columbia, $2.29; from Rockton, $2.63 per net ton, subject to carload minimum of 60,000 lb.

Southwestern Freight Bureau Docket

3170. Cement. To establish the Monroe, La., basis of rates on cement, portland, hydraulic and paving. Carloads, minimum weight as per S. W. L. Trf. 90E, from producing points shown in the tariff referred to, to the points shown below: Mo. Pac. R. R.—Huttig, Ark.; Litro, La.; Dean, La.; Haile, Ark.; Spencer, La.; Parks Spur, La.; Sterlington, La.; Lock Arbor, La.; Phillips, La.; Lampkin, La.; Idevan Spur, La.; Monroe, La.; Ark., La.; Mo. Ry.—Huttig, La., and Pine Bluff Ry.—Huttig, Ark.

It is stated that the proposed rates are necessary in order to place the stations on the Mo. Pac. R. R. between Monroe and Litro, La., on a parity with cross-country points on the A. & L. M. Ry., and are the same as in effect to stations on the Mo. Pac. R. R. north of Monroe, La. The changes proposed to Litro, La., and Huttig, Ark., are necessary to take care of the Fourth Section.

3194. Cement. To amend all tariffs, naming rates on cement, other than asbestos cement, from, to and between points in S. W. F. B. territory, to provide for the following description: "Cement; hydraulic, portland or natural, carloads," no change to be made in present minimum weight. It is stated that what is desired is to clarify and provide a uniform description on cement.

3206. Cement. To establish I. C. C. Docket No. 8182 Scale 2 rates on cement, portland and hydraulic, carloads, minimum weight 50,000 lb., from Marquette, Mo., to points in Missouri, Kansas and Iowa. It is stated that the scale proposed is now published from Hannibal, Mo., to points in Missouri, Iowa and Kansas, and it is felt proper to apply it also from Marquette, Mo., to the same territory.

3208. Cement. To establish a rate of 23½ cents per 100 lb., on cement, portland and hydraulic, carloads, minimum weight 50,000 lb., from St. Louis, Mo., and East St. Louis, Ill., to Ada, Okla. It is stated that the proposed rate is now published for northbound application and that the plant at Ada desires to purchase on a special brand of cement at eastern producing points.

Western Trunk Line Docket

2556D. Sand. Carloads, from Red Wing, Minn., to Bettendorf, Iowa. Present, 15½ cents per 100 lb.; proposed, 9½ cents per 100 lb.

2556E. Stone, crushed and ground. Carloads, from Winona, Minn., to Chicago, Ill., and Milwaukee, Wis. Present, Eau Claire, Wis., rate of 11 cents applies account Winona intermediate; proposed, 9½ cents per 100 lb. Minimum weight 90% of marked capacity of car except that when weight of shipment loaded to full visible capacity of cars is less than 90% of the marked capacity of car actual weight will apply, but in no case shall minimum weight be less than 40,000 lb.

Indiana Gravel Freight Rates to Be Reconsidered

THE Indiana public service commission has issued an order directing a hearing to be held soon without formal pleadings to study the propriety of increased rates which the commission, in orders issued some time ago, granted on carload shipments in intrastate transportation of sand and gravel. The hearing will delve into the lawfulness of rates, charges, classifications, regulations and practices in this matter.

The new schedules were to become effective January 1, but the order suspended the date of taking effect for thirty days after that date. The order issued said that it appeared that the schedules make certain increases in rates and that the rights and interests of the public appear to be injuriously affected.—*Indianapolis (Ind.) News.*

Cut in Retail Lime Price on Pacific Coast

SAN JOSE (Calif.) *News,* under date of Oct. 27, publishes the following item: Henry Cowell Lime and Cement Co. reports a drop of 50 cents per bbl. on Santa Cruz lime in both carload and less than carload prices. This now brings the retail price in San Jose on Santa Cruz lime to $2.65 per bbl., whereas the former retail price was $3.15 per bbl. An allowance of 25 cents each for empty barrels returned brings the cost to $2.40 per bbl. net. It is expected that this large decline on the price of Santa Cruz lime will greatly stimulate building operations all along the coast.—*Pacific Builder, San Francisco, Calif.*

Sand and Gravel Deposit Increases Rapidly in Price

RACCOON Island, in the Ohio river near Gallipolis, Ohio, was sold by Captain Moses Epling of Point Pleasant and associates of Pittsburgh, Penn., to the Union Sand & Gravel Co. of Huntington, W. Va., for $40,000. Captain J. C. Shepard of Gallipolis purchased the island two years ago for $350. He sold it to Captain Epling for $12,500.

Developments in Machinery and Equipment

Great Increase in the Use of Gasoline-Motored Units —Growing Use of Power Transmission Devices and Speed Reducers in Place of Belt Drives

LOOKING back through the "New Machinery and Equipment" pages of ROCK PRODUCTS for the year just closing, we find by far the largest amount of space has been devoted to "Excavating and Material Handling Equipment." The outstanding feature of this field is the greatly increased use of gasoline and oil engine powered units, as well as the wider adoption of electric-powered equipment. The next largest amount of space was devoted to "Power and Power Transmission Equipment" and here we find that the outstanding feature is the great interest developed by the rock products industry in geared power transmissions and speed reducers. Many manufacturers of such devices are beginning to realize that cement lime, gypsum and rock-crushing plants are operations especially requiring such power-transmission devices.

We believe there is keen competition in all machinery lines, but that manufacturers are appreciating more and more that service and life of equipment are demanded rather than the lowest possible prices. There is unquestionably more and more attention being paid by equipment manufacturers to the special needs of rock products operators and less equipment suitable for general construction work, but not rugged enough for hard continuous service in quarries is finding its way into the hands of experienced quarry operators.

With the increasing feeling on the part of operators that plants are really permanent, we find that equipment and machinery are being considered also from the angle of permanency, or at least greatest possible service.

As elsewhere mentioned while producers are not particularly optimistic over the possibility of greater expansion in the near future they are practically unanimous in the opinion that further investment in machinery and equipment to reduce costs is not only desirable, but essential. Several believe that the greatly increased use of labor-saving machinery is the outstanding development of the year.

Drilling and Blasting

THE year 1924 has seen a remarkable amount of interest in limestone mining. The advantage of being able to operate the year round, of a clean product, of the avoidance of handling a large amount of stripping are being recognized by commercial crushed-stone operators as well as lime and cement manufacturers. The articles of J. R. Thoenen published serially in ROCK PRODUCTS during 1924, which were written as a result of Mr. Thoenen's investigations in the field as a special representative of ROCK PRODUCTS created so much interest that the U. S. Bureau of Mines has employd Mr. Thoenen to make a much more complete investigation as a special government representative.

Growing Interest in Mining

In operating limestone mines producers have had occasion to study and investigate mining methods and equipment and we find that they have quite universally utilized the experience of such concerns as the Denver Rock Drill Manufacturing Co., Denver, Colo., which has specialized in underground drilling equipment for many years. Joseph A. Walshe of this company tells us that "during the year 1924 there have been a few new adaptations of hammer type rock drills to the non-metallic mineral industries. There appears to be a growing tendency towards the use of the heavier types of primary blast hole drilling, either independently or in conjunction with well drills. In the latter case the objective is better fragmentation in order to minimize the amount of secondary drilling. Greater speed has been attained with only a fraction of the outlay for equipment.

"In the manufacture of rock drills, many new and superior designs have been placed on the market. The Denver Rock Drill Manufacturing Co. has devoted its efforts to the perfection of a new line of "Turbro" or independent rotation drills. This series includes derrick drills for open-cut quarries, quarry bar drills for broaching and channelling, tunnel drills, bench drills, and stoping drills for taking down the roof. In short the new series includes a type suitable for every condition of rock drilling within the scope of the hammer drill. The rotation of the drill steel is effected in all these models by means of a turbine driven through a worm and worm gear reduction. Drop forgings, high grade alloy steel, and steel are used

Limestone mining operation profiting by years of experience in underground drilling and blasting

throughout. The manufacturing processes in the rock drill industry are worthy of mention because of the precision which must be maintained. Limits and tolerances are far closer than is generally supposed. In the more critical dimensions, a quarter or half thousandth limit is not uncommon, while one thousandth is considered fairly generous.

"Summing up, these new independent rotation Waugh Turbro rock drills possess many new advantages and are a valuable contribution to the industry. Faster drilling, greater ease in setting up and collaring, power and flexibility to overcome troubles in bad ground, and ease of operation are their chief characteristics.

"In all cases the weight is held to the minimum necessary to insure durability and dependability under the most severe operating conditions.

THE NEW WAUGH TURBRO SERIES

Model	Class	Weight
331	Tunnel, Quarry Bar or Derrick	146 lbs.
34	Tunnel, Quarry Bar or Derrick	225 lbs.
337	Tunnel, Quarry Bar or Derrick	125 lbs.
37	Bench, Toehole, Pophole	65 lbs.
39	Stoper	99 lbs.

Bigger Well Drills

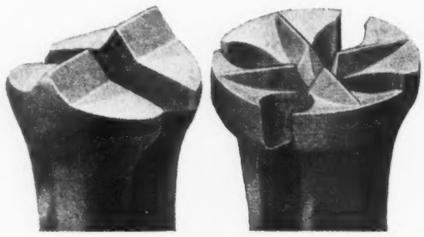
In open quarry work there has been a very appreciable increase in the use of well drills where it was hitherto considered impossible to use them, as for example on very high faces of exceedingly hard and tough trap rock. M. B. Garber, of the Sanderson-Cyclone Drill Co., Orrville, Ohio, states: "The most important tendency in big blast hole drilling during the past year has been toward larger and heavier equipment. Formerly a 6-in. hole was considered large. Now 8-in. holes are being employed in some of the harder rocks, such as trap and granite. It is possible to space these 8-in. holes farther apart if the rock is of the kind that has good fragmentation. This, of course, means less lineal feet of hole must be drilled.

"During the past year, the No. 14 'Super Drill,' a third and largest size to our line of special blast hole drills, has been perfected and there are now more than fifty of these machines in use. This machine does not have a pound of cast iron on it except in the power equipment and one or two bearing bushings, everything in the way of castings, being cast steel. The gears all have cut teeth and are extremely heavy. It will swing a 5 in. by 20 ft. stem at 60 strokes per minute without any vibration."

Drill Bit Dressing Machines

The Armstrong Manufacturing Co., Waterloo, Iowa, has been giving special attention to better drill bits and W. J. Walsh of this company considers the perfection of the Armstrong patented bit-dressing machine their most important contribution to the industry in 1924. Mr. Walsh writes:

"In designing these special bits, our designing engineers worked on the theory that a drill bit to prove successful in hard rock drilling, must perform four necessary important functions, namely: (1) *Penetrate;* the rock must be fractured or broken up in the bottom of the hole; (2) *Crush;* the fragments or rock chips must

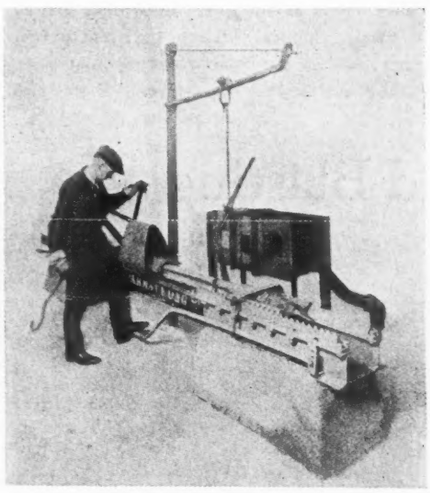


New design of drill bits

be ground or crushed to powder; (3) *Ream;* the wall of the hole must be reamed round and smooth as the drilling proceeds; (4) *Mix;* the powdered rock in the bottom of the hole must be mixed with water and held in suspension.

"The bits were therefore designed with: (1) A sharp angle penetrating edge to break up the rock; (2) a large area of cutting face to grind it into powder; (3) a perfect reaming edge to keep the hole round and true; (4) free water courses to mix the cuttings well for bailing out.

The machine itself, is made entirely of steel and can be operated by a gasoline



New bit-dressing machine

engine or electric motor, or directly off a line shaft if available. The maximum power to operate is 10 h.p. for a period of about 15 seconds while the forging operation is in progress. Where there is no drop in the line voltage a 5-hp. electric motor will handle the load for this short period and is being used on the majority of installations.

Small-Size All-Steel Well Drill

"In addition to the patented bit-dressing machine produced by the Armstrong company during the past year, they have also designed a new model all-steel blast hole drill, which is smaller than any of their other models, and is especially designed for the operator with limited production, who wants to secure all the advantages of big blast hole drilling without making a heavy investment.

"It has a steel frame and derrick, as well as all the exclusive features of construction and operation that are found on the larger Armstrong models, only it is lighter in weight (weighs only 5,000 lbs.), and is equipped for manila cable only, with large diameter sheaves which reduce cable wear, and keeps the weight and cost down to a minimum."

Crawler-Tread Drill

Another notable achievement in well drills is the crawler-tread outfit of the Loomis Machine Co., Tiffin, Ohio. This was brought out early in the year and was described in detail in Rock Products, March 22, 1924.

The Hardsocg Promotion Co., of Ottumwa, Iowa, is also giving special attention to rock drill bits, as noted in Rock Products, December 13, 1924, page 61.

The Colonial Steel Co., Monaca, Penn., writes that there is an increasing demand for vanadium drill steel.

Explosives

F. J. Byrne, of the E. I. du Pont de Nemours & Co., Wilmington, Del., has supplied an interesting summary of developments in explosives during the current year. We presume the other powder companies have developed similar new explosives. Mr. Byrne writes:

"The most noteworthy advance in explosives for quarry use during the year 1924 has been the development by the E. I. du Pont de Nemours & Company of a new gelatin dynamite, known as "Quarry Gelatin." Like the older gelatins, this is a dense, plastic, water resisting, low freezing explosive. Its distinguishing characteristic is its superior strength. Grade for grade, "Quarry Gelatin" is considerably stronger than the other gelatins. In many quarries it has been found that 30 or 40 per cent "Quarry Gelatin" will pull the bottom as clean and give as good breakage respectively as ordinary 40 or 50 per cent gelatin. Where the substitution of the lower grade explosive is feasible, it results in a material reduction in the cost of getting out the stone. "Quarry Gelatin" is suitable only for open work. As its fumes are objectionable in close work, it cannot be used in those operations where the stone is mined underground.

"Quarry Straight" is another new du Pont explosive formulated on the same principle as "Quarry Gelatin" for open work only. It is stronger and more shattering than the corresponding grades of regular straight dynamite.

"The third new du Pont explosive of

the year is "Arctic Special." This is a powder of the nitrostarch type which does not burn, does not produce a headache, and does not freeze. It is made in only one strength, 52% on a weight basis.

"The perfecting of a new light weight blasting machine has also been of considerable benefit to quarrymen. This is known as the No. 3-A du Pont blasting machine. Although it will fire 50 electric blasting caps with 30 foot copper wires, it weighs only 23 pounds.

"In well-drill blasting, the past year has seen an increasingly strong trend toward the use of cordeau as a detonating agent. This facilitates the priming of broken charges and insures detonation of the explosives at maximum velocity. Most large quarry shots are now fired with cordeau in the holes and a trunk line of cordeau on the surface.

Waterproof Blasting Caps

"Another improvement in blasting practice that is gaining headway is the use of du Pont waterproof electric blasting caps" instead of ordinary electric blasting caps, even in work that is only moderately wet, when holes are to be connected in series. The failure of center holes in such a shot where connections were properly made, the blasting machine was up to capacity and the electric blasting caps could be detonated after the blast has frequently puzzled quarrymen. A number of years ago the du Pont company carried on some experiments which showed that such failures were often due to current leakage from the cap wires and that this current leakage, in turn, was induced by the high conductivity of ground water containing even a small quantity of earthy salts in solution. In du Pont waterproof electric blasting caps, not only is the cap itself especially protected against the entrance of moisture, but the wires also are protected by an enamel coating under the cotton insulation. Even if water penetrates through this cotton wrapping it cannot reach the copper. Consequently this type of detonator prevents misfires due to leakage of electricity from the cap wires and its use is advisable wherever the ground water is hard and there are more than 20 holes connected in series."

Rheostat for testing blasting machines

Testing Blasting Machines

The Atlas Powder Co., Wilmington, Del., announce a new Atlas rheostat for testing blasting machines. This rheostat provides an inexpensive means of determining the capacity of a blasting machine. There are two ways of determining whether a blasting machine is up to its rated capacity. First, a circuit of the required number of electric blasting caps can be connected up and an attempt made to fire them all. Second, a circuit using one electric blasting cap and substituting the proper resistance for the remaining electric blasting caps. If the one electric blasting cap fires, it is presumptive evidence that the blasting machine will fire up to its rated capacity. The Atlas rheostat furnishes the artificial resistance needed. It saves the cost of the extra caps. It aids in detecting "shorts" in circuits. It prevents misfires and is a safety device.

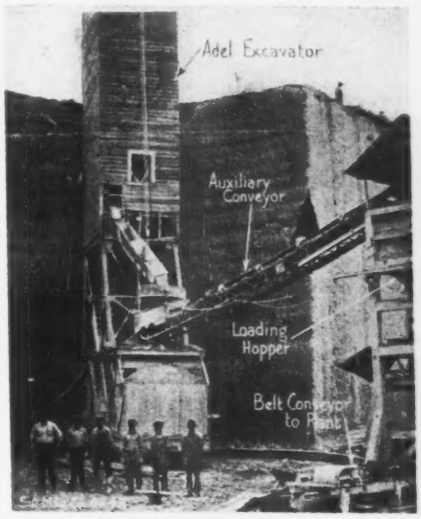
Excavating and Material Handling

DURING the year we have described 23 devices that come under the heading "Excavating and Material Handling," including four adaptations of the Fordson tractor to uses in quarry and gravel-pit operation. Three new gasoline-engine powered hoists were brought out (Meade-Morrison Manufacturing Co., East Boston, Mass., February 9; Thomas Elevator Co., Chicago, Ill., April 5; and the Flory Manufacturing Co., Bangor, Penn., November 29).

There has been much competition among shovel, crane and hoist manufacturers and changes and improvements have been announced practically every month. As already mentioned there has been a wide adoption of gasoline and oil-engine powered shovels and cranes. Oil-engine shovels to 50-ton size are now built by the Bucyrus Co., South Milwaukee, Wis. (Rock Products, November 15, 1924).

We also find electric shovels, particularly in the large sizes, increasing in favor in spite of their very high initial cost. The equipment of quarry shovels with crawler treads has proceeded with quite remarkable rapidity. During the year the Osgood Co., Marion, Ohio, which has long featured its traction-wheeled shovels announced a new crawler-tread, so that now practically all the principal shovel manufacturers are recommending crawler treads. However, there are still quarry men who swear by the older railway type shovel, especially in quarries where a track gang is employed on railway track maintenance and where the quarry floor is not smooth.

The number of manufacturers of the smaller sizes of gasoline shovels is constantly on the increase. During the year the Link-Belt Co., Philadelphia, Penn., and Chicago, Ill., long manufacturers of locomotive cranes, have met the competition of the convertible shovel-crane manufacturers by the announcement of a shovel attachment for their cranes.



The one new excavating device of 1924

The only really new excavating device

Heavy duty crawler tread shovel-crane

View of plant and quarry of Annville Stone Co., Palmyra, Penn.

we have run across is the Adel excavator made by the Stephens-Adamson Manufacturing Co., Aurora, Ill., for digging clay at the plants of the Gulf States Portland Cement Co. and the Trinity Portland Cement Co. This is a tower device with a vertical chain of buckets which works against a face of stiff clay about 40 ft. high. A similar device has long been used at clay products plants, but probably few cement plants have clay banks adapted to its use. It travels on a semi-circular track and delivers material to an auxiliary belt conveyor and thence to a car-loading hopper.

Developments in Shovels

The Osgood Co. reports that they have "seen during the past year the increasing popularity of their heavy traction mountings for the larger sizes of railroad type shovels.

"A noticeable tendency is the apparently increasing preference for the smaller sizes of standard revolving shovels in work which was formerly considered only suitable for railroad type shovels. A large number of Osgood 1¼-yd. machines are to be found in such work as stripping, digging and loading stone in quarry work and other installations requiring power and stamina.

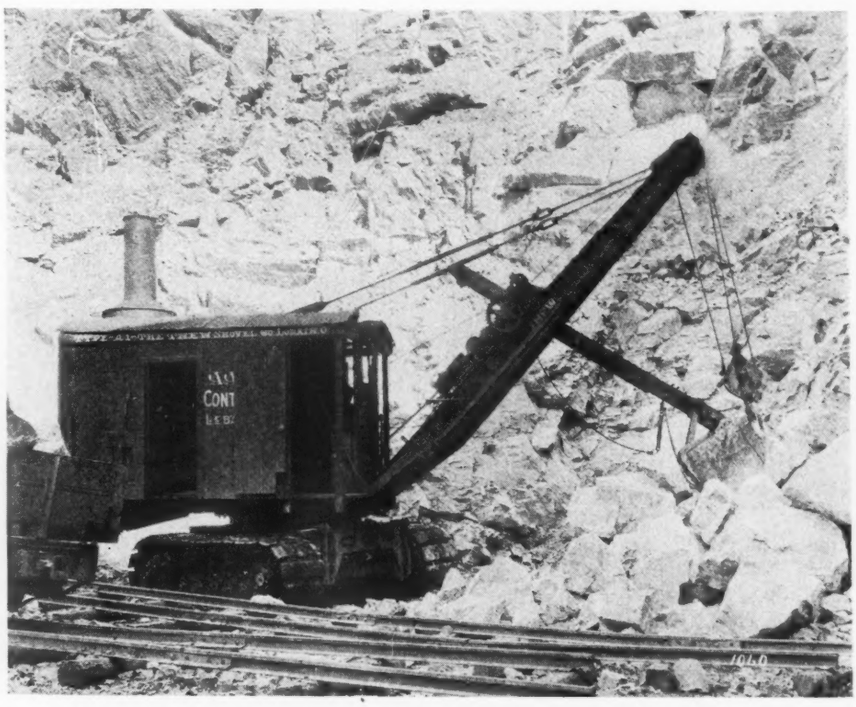
"Among the interesting machines built by the company during the past year are special compressed-air shovels owned by the contracting firm of Hitchcock and Tinkler of Denver and used on the great Moffat tunnel in Colorado. These shovels are special adaptations of the Osgood 43—normally rated as a 1½-yd. machine. They are of 3-ft. gage, with narrow bodies, special jack arms, short booms and handles and a 1-yd. rock type dipper." This is shown at the end of the review on transportation equipment on page 155.

Small Revolving Shovels

The editors have also noted the increasing use of small revolving shovels where one would expect only the heaviest type machines to be used. A. E. Little of the Thew Shovel Co., Lorain, Ohio, sends an instance of such an installation. "The view herewith was taken at the Palmyra plant of the Annville Stone Co. at Palmyra, Penn., and their methods of working are rather unusual.

"This company relies upon a Thew type A-1 steam shovel of 1 cu. yd. capacity for the entire production, which has amounted to as much as 1068 tons in one day. Their average daily production, over an extended period, has amounted to 880 tons. The quarry face is approximately 125 ft. high and the pit 200 ft. wide.

"At the present time the loading is being done about 500 ft. from the crusher, which is installed upon the quarry floor. Two 6-ton side-dump cars of special design and dumped with an air cylinder are used on the double loading track, the shovel easily reaching either track so that a perpetual movement can be maintained by the cars. These cars are moved alternately by a Whitcomb 7-ton gasoline locomotive. The car on one track is loaded while the other is being moved to the crusher and unloaded. It discharges into a 36-in. wide by 12-ply Robins belt conveyor, which rises from the quarry floor to the screenings and loading station 100 ft. above. This conveyor passes through a tunnel driven upward through the wall of the quarry at an angle of 23 deg. and is so located to bring the position of the crusher in the center of the quarry floor. This is an unusual angle for a belt conveyor and quite a departure from the ordinary, but the Annville Stone Co. states that even at this pitch the stone is carried



This 1-yd. shovel does all the loading for the Annville Stone Co. and has loaded 1068 tons in one day

A 350-ton electric shovel in a Michigan quarry

very nicely and with practically no spill."

However, big producers are using bigger and stronger equipment. One of the many notable achievements made by the Marion Steam Shovel Co. recently is the equipping of a Michigan quarry with 350-ton electric shovels.

New Oil-Engine Shovels

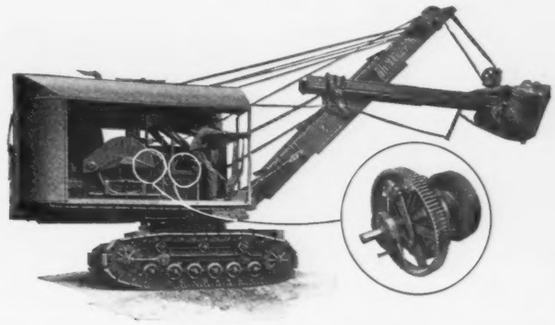
The Harnischfeger Corporation of Milwaukee, Wis., has added a Diesel engine-driven machine to its line of power driven excavators. The Model 208 machine, which is illustrated here, is provided with a 1 cu. yd. struck measure dipper and can also be equipped with 1 cu. yd. dragline or clamshell bucket operating on a 40 ft. boom. The Diesel operated machine is a comparatively new development in excavating machinery. It has the advantage of very high thermal efficiency and will burn a cheap grade of fuel oil. The engine is of the mechanical injection type and is of simple, rugged construction. The crank shaft, wrist pins, bearings, etc., are of extra heavy construction. The speed is very low, reducing vibration to a minimum.

W. H. White of the Harnischfeger Corporation also announces that his company have "recently developed and made practical application of a new clutch control device, operated by the power of the engine and adapted for use on the P. & H. excavators.

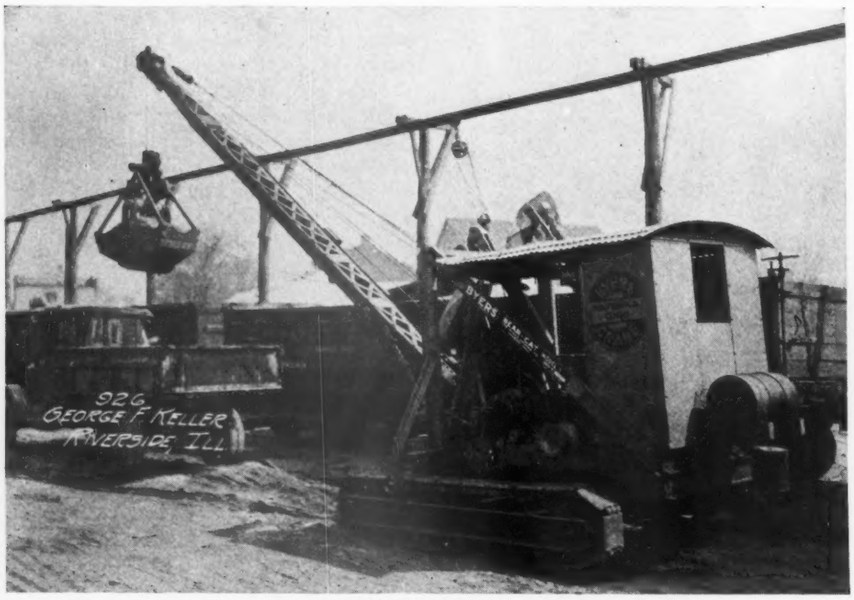
"This new device enables the operator to control movements of the machines with approximately one-tenth of the physical effort which was previously required. It is simply a small auxiliary brake with attachments which causes the power of the motor to operate the main drum clutches. When the spur gear is rotating, the drum clutch, clutch operating arm and drum all rotate with it. The auxiliary clutch band is stationary, the dead end being fastened to the machine frame and the other end to the operating lever. When the operator pulls the lever towards him, the auxiliary clutch band is tightened about its drum, retarding the rotation until the clutch operating arm has been rotated sufficiently to cause the main clutch to grip the drum. The average pull required to operate this control device is about 4½ lb. There are only a very few moving parts and the whole operation is very simple. There is very easy accessibility for lubrication and adjustment. Patent rights have been applied for on this device."

American quarry men may have noticed the advertisements in Rock Products of Ruston and Hornby, Ltd., Lincoln, England, manufacturers of power shovels and cranes. This is because Rock Products has a world-wide circulation in the quarry industries. The view herewith shows one of the English shovels in a basalt quarry on the west coast of Scotland near Ayr. "This basaltic rock is in column formation similar to the well known Giants' Causeway. The columns are roughly 6 ft. across and the rock is brought down by means of explosives. The shot holes are

Quarrying columnar basalt near Ayr, Scotland



Left—Diesel-powered shovel which can be converted to crane or dragline. Right—Mechanism of new clutch-control device



This light-weight model crane is virtually six machines in one

drilled in about 12 ft. at the foot of the columns, a number of holes being fired at once so as to bring down several thousands of tons at a time.

"The interesting feature about the blasting is, that the columns into which the holes are drilled collapse in vertical fashion like the felling of a tall chimney stack by knocking out the foundations or supports.

"The rock is used for road making purposes and is in considerable demand.

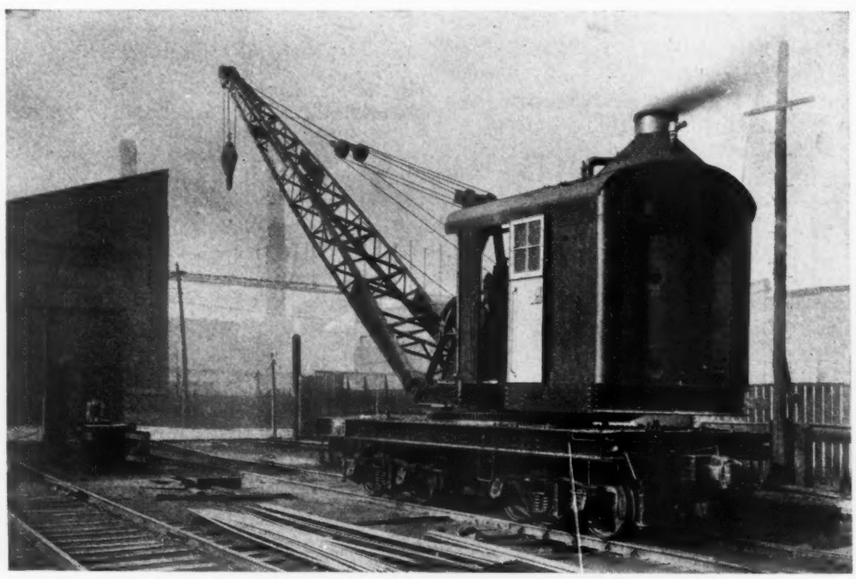
"The Ruston shovel in the foreground has been especially built for deep face quarry work, the jib being designed to allow the machine to stand well back from the face to prevent occasional falls of stone from damaging the machine.

"These shovels weigh about 60 tons each and are fitted with buckets of 3 cu. yd. capacity."

Two New Locomotive Cranes

The Byers Machine Co., Ravenna, Ohio, announce "a new model light-weight industrial crane with interchangeable attachments so that it is equally effective as a crane, as a ditcher, as a shovel, etc. This model, the 'Bear Cat,' is virtually six machines in one, built to give speed and economy in all-around work. A good operator, it is claimed, can easily make three round trips per minute with a ½-yd. bucket on ordinary loose material such as sand or gravel. The ditcher scoop is furnished in three sizes, 25 in. to 37 in., and cuts to a depth of 17 ft. behind the machine or 9 ft. beside the machine. It will dump at an elevation of 8 ft. into trucks, and the power applied at the dipper teeth is 9500 lb. The machine can be satisfactorily operated on a grade of 20 deg.

"Equipped with skimmer attachment, the 'Bear Cat' is said to be a very efficient road grader, and might be used for light stripping. It has a 12-ft. cutting stroke and a two-part digging line, giving it a very great digging power for a machine of its size. The ½-yd. bucket is of the bottom dump type, no ground man being necessary. Other attachments provided are a shovel for regular excavating, a back filler, dragline and magnet.



Improved model of 20-ton capacity crane

"The 'Bear Cat' is mounted on full crawlers, spaced unusually far apart, giving it traction and stability on all kinds of ground. It is equipped with a 35-hp. gasoline engine, and is of exceptionally sturdy construction throughout. It can mount a trailer on its own power for quick hauling by a motor truck. Electric power can be used instead of gas where desired."

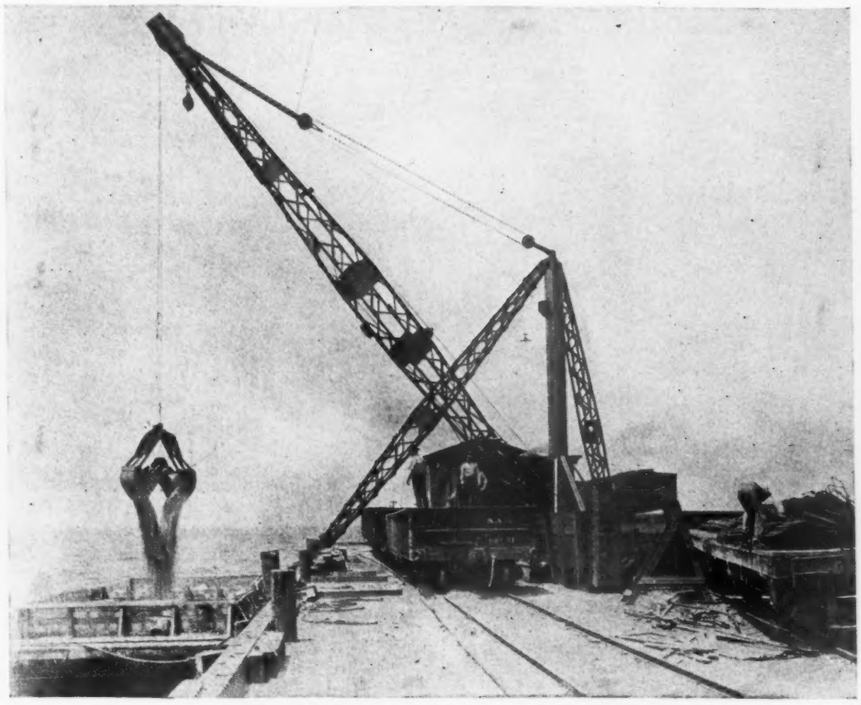
G. F. Clino, Jr., of the Brown Hoisting Machinery Co., Cleveland, Ohio, states:

"The Brown Hoisting Co. have just brought out a greatly improved model of their No. 4, 20-ton capacity locomotive crane. The more noticeable changes are: The high boom hitch, the wide truck frame, the extra large diameter rotating ring and the contour of the cab. The latter presents a more pleasing appearance and it is of better construction.

"The crab has been simplified by the elimination of one shaft, thereby making the remaining parts much more accessible. The drums are independently driven and free running with outside band clutches. The worm gear boom hoist runs in an oil bath and this, with the high boom hitch, makes booming with loads an easy operation.

"An innovation in locomotive crane construction is the specially constructed wide truck frame with a center sill running the entire length, to which are fastened the friction-type draft gearings. In consequence of the wide truck-frame an extra large rotating ring is made possible, which materially adds to the stability of the crane. The load rollers that support the revolving superstructure are larger and are removed from above without jacking up the superstructure. The vertical rotating shaft can also be removed from above.

"The cumbersome and unsightly counterweight device for retrieving the tag line and electric cable in grab bucket and magnet work has been discarded and in its place an arrangement that is both compact and novel has been installed. The main hoist shaft is extended through the crab far enough to accommodate a small drum and 'niggerhead,' the latter being keyed to the shaft. The small drum, upon which the tag line or electric cable



Derrick especially adapted for unloading barges

is wound, is rotatably mounted on the shaft and is driven by the niggerhead through a slip friction device."

Increasing Number of Uses for Derricks

Many derricks are used in the rock products industry for one purpose or another. One of the commonest, perhaps, in the sand and gravel industry is for unloading scows at wharves. A recent installation of this character by the American Hoist and Derrick Co., St. Paul, Minn., is shown herewith.

The Clyde Iron Works, Duluth, Minn., sends the view herewith of a derrick installation at the Keays mine of the Rock Products Co. at Perth, Ont. This is a feldspar operation.

Some New Hoists

The Meade-Morrison Co., East Boston, Mass., announce a new line of electric hoists, especially designed for use with slack-line excavators. It is claimed by the manufacturers that: "It has been the aim in the new design to simplify the operation of the hoist so that the time of manipulating the levers will be cut to a minimum, allowing the operator to handle the greatest possible yardage of material per day. In the old machines a slip-ring motor having drum controller was an essential, but in the new design with the Meade-Morrison patent automatic brake a constantly running motor is used, thus relieving the operator of the extra effort and time involved in starting and stopping the motor with each trip, also avoiding the peaks due to such operation. These machines have the usual arrangement of two tandem friction drums, one arranged for two speeds for the dragline, and the other for single speed for tightening the inclined cable, both these drums being provided with brakes constructed to automatically sustain the load at all times and adapted for lowering the load.

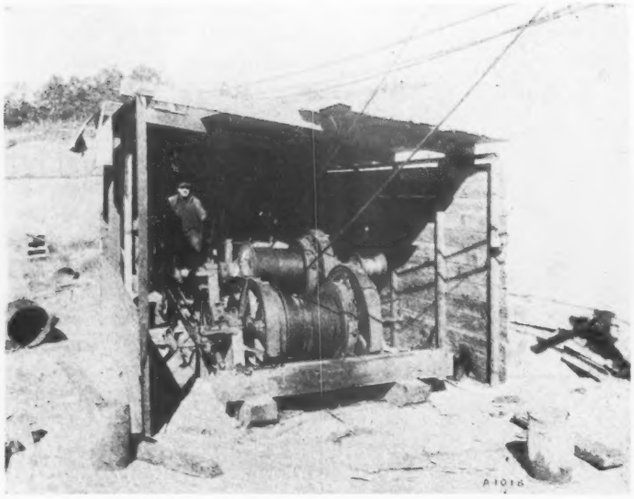
"The brakes on the drum normally are set against reversal of drum and lowering of load, but automatically take the load when the friction by which it is hoisted is released. The operator thus does not have to set a brake to hold the load when he releases the friction by which it has been lifted. This practically cuts in two the manual labor of handling the load.

"The drum clutches are all of the friction cone type, arranged to secure uniform expansion due to heat. The inner cone of each clutch is covered with asbestos brake lining so applied that the lining can be removed and replaced without removing the drum shaft from its bearings.

"The upper or cable drum is provided with clutch at one end of the drum, driven by corresponding drum gear. The lower, or dragline drum, is provided with a clutch at both its ends, each driven by corresponding drum gear. The clutch at one end of the drum is of large diameter for heavy pull and engages with gear driven at slow speed, this gear being bronze bushed and turning on the shaft to which the drum is firmly keyed. The opposite end of this drum is provided with clutch of smaller diameter driven by corresponding gear to give high speed for pulling the bucket up the inclined cable. The gear is also bronze bushed and turns on the shaft.

"The clutch for the high speed gear is of standard construction, but the larger clutch for the slow speed gear at the opposite end of the drum is of the automatic releasing type. This clutch, when applied, is effective to turn the drum in the rope winding direction, but is ineffective to resist rotation of the drum in the rope winding direction relative to the slow speed gear, this construction being provided to make it impossible for the slow speed friction to pull against the high speed when the load is being trans-

Derrick installed at an Ontario feldspar operation



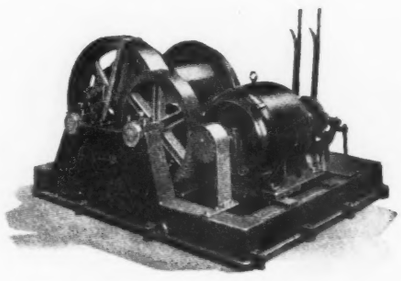
Left—New electric hoist especially adapted for slackline cableway operation. Right—An application of this hoist

ferred from the former to the latter after the bucket has been filled, and to simplify the operation of the excavator. In operation when, with the slow speed clutch thrown in, the bucket is nearly filled, the operator throws in the cable line clutch with one hand to lift the bucket. When the bucket is hoisted clear of the ground so that the heavy line pull is not required, the high speed clutch is thrown in by his other hand and the drum is then driven by the high speed clutch the low speed clutch having automatically released the drum to run at the higher speed. This absolutely prevents any overloading of the motor or excessive heating of the frictions due to simultaneous application of both low and high speed clutches, which is liable to happen with the usual arrangement of clutches unless the operator is very careful. Furthermore, as the operator has not needed to throw out the slow speed clutch, this clutch will automatically become operative for slow speed pull when the dumping position is reached, upon the release of the high speed clutch.

"For operating this machine, Mead-Morrison have provided five banked levers with latches and quadrants as follows: No. 1 lever for applying the slow speed dragline clutch, No. 2 lever for applying the high speed dragline clutch, No. 3 lever for releasing the automatic brake on the dragline drum, No. 4 lever for applying the clutch of the cable drum and No. 5 lever for releasing the brake on same. It is unnecessary with these machines to start and stop the hoist each trip, as equally smooth and more rapid and efficient operation is obtained by running the motor continuously.

New Hoist for Quarry Service

The Thomas Elevator Co., Chicago, Ill., have just brought out a hoist especially designed for quarry service. This is a double reduction, single-drum mine hoist.



New single drum mine type hoist adapted to quarry service

"These hoists are of heavy design with large drum. They are equipped with band frictions of the flat band type. The friction bands are lined with heavy duty asbestos composition lining, which is recognized to be the best wear resisting clutch lining made, and are fitted with drop forged clips and toggles. The brake is of extra heavy design and by being located on the opposite end of the drum from the friction any heat generated by slipping the brake while lowering the load down a long incline or deep shaft cannot affect the friction.

"As regularly furnished the drum is cast smooth. Machine cut gearing is used exclusively and the pinions are machine cut from solid steel forgings. The brake and friction shafts are fitted in babbitted bearings; control levers are banked in quadrant, conveniently located for the operator. The teeth in the quadrant bars are machine cut and the operating levers have turned handles with spring latches.

"These hoists are regularly furnished with the Thomas automatic motor brake, a safety feature that has all of the advantages of a solenoid with none of its disadvantages."

Two-Speed Hoists

Sauerman Bros., Chicago, Ill., state that "Sauerman two-speed hoists have been designed that would give rope speeds as high as 1000 ft. per min. for inhauling the loaded bucket, the digging speed being unchanged from their standard digging speed of 250 ft. per min.

"A Sauerman two-speed electric motor hoist has been brought out, possessing the unique feature that the change of speed is made electrically instead of mechanically, a two-speed high torque motor of special design being used. The consequent reduction of friction losses by elimination of the gear contacts, bearings and other wearing parts that are required on a hoist where the change of speed is made by mechanical means enables the Sauerman two-speed electric motor hoist to show a saving of about 20% in power consumed.

Improvements in Cable Excavators for Sand and Gravel

"Sauerman engineers have also developed roller-bearing sheave blocks for the mast top assembly of Sauerman cableways. These blocks will give 30 days or more of continuous service without requiring lubrication and contribute a great deal to rapid and smooth operation of a cableway.

"A Sauerman cableway with a 3½ cu. yd. bucket has been developed for reclaiming sand and gravel to a river-side screening plant. The capacity of this machine on an operating span of 300 ft. is 175 cu. yd. per hour.

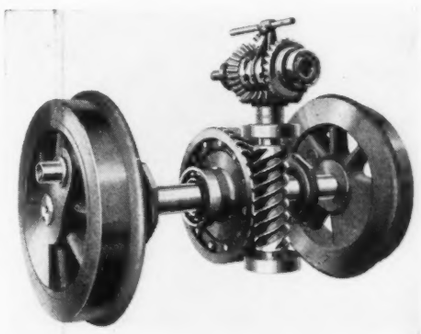
"Renewable wearing blades and manganeses steel teeth have been designed for all sizes of 'Crescent' (patented) power drag scrapers. The blades protect the body plates of the scraper buckets and can be adjusted or renewed as they are worn down. The manganese steel teeth are of special design to make digging easier and also to protect the body plates of the scraper."

Transportation Equipment

MOST of the notable development in locomotives during 1924 was in gasoline-powered units. There was much progress made in the construction of larger, heavier and more powerful units; in other words gasoline locomotives are invading still further the field of small steam locomotives. In our February 23 issue we announced a new 7-ton Davenport gasoline locomotive; on October 18 a new 15-ton Whitcomb and on November 15 a new 8-ton Plymouth. We understand a 15-ton Plymouth is being built and will soon be announced. Formerly most gasoline locomotives were about 6 tons. It is to be presumed that cheap gasoline has had much to do with the increasing use of gasoline locomotives, but the fundamental reason for their popularity is probably in their much cheaper first cost, the fact that most any bright boy can operate one, and their increasing sturdiness and reliability.

An important and successful experiment in sand and gravel plant transportation was described in Rock Products, May 31, 1924 at the Montgomery Gravel Co., Montgomery, Ala. Here 25-ton General Electric Co. storage-battery electric locomotives are being used and the installation is pronounced by its owners highly satisfactory.

The problem of the selection of quarry and gravel pit transportation equipment is a quite important one, and one we believe that does not receive as much consideration as it should. Evidently the length of haul is or should be the determining factor. Where the face of the quarry or pit is close in to the plant and the greater part of the track system has to be frequently shifted, narrow-gage, comparatively light equipment is desirable. But where



View of worm drive and reversing gears mounted on rear axle of Vulcan locomotive, with entire casing removed

the operation has assumed a permanent character and the length of haul is increasing, a larger and larger percentage of the track system becomes permanent, and the same laws of economics apply as in any railway operation—the larger the car units and the longer the trains the less the cost of transportation. We find this applied to some extent in the gravel and quarry industries.

Typical New Gasoline Locomotive

Announcements of two new gasoline locomotives come just the right time to include in this review. They give an excellent idea of the trend in this direction:

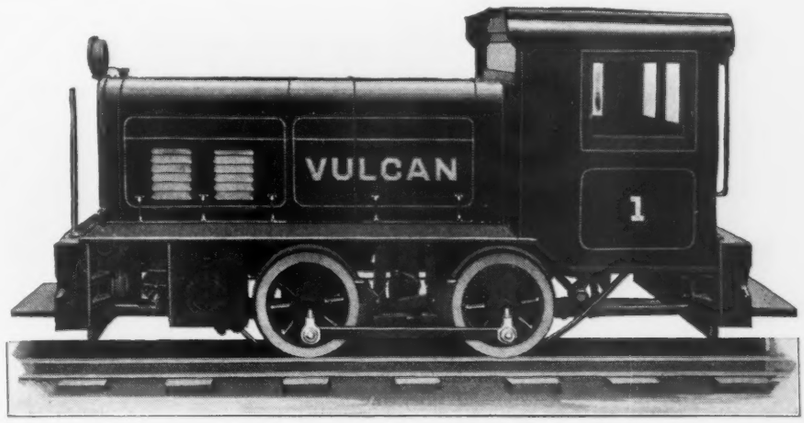
The Vulcan Iron Works, Wilkes-Barre, Penn., manufacturer of steam, gasoline and electric locomotives, has recently designed a 7-ton, high-powered gasoline locomotive, class I. G. S., know as the "7-ton Special." It is of the worm-gear-drive type, which drive has been an exclusive feature of Vulcan gasoline locomotives for many years. The worm drive and reversing mechanism is mounted as a unit in a cast steel, oil tight, dustproof housing made in halves, placed in the center of the rear axle, permitting quick and easy assembling or dissembling without the necessity of removing the axle from under the locomotive.

The transmission is of the four-speed, selective-gear type, gears being of the constant mesh jaw type; and speed changes are made through jaw clutches, thereby eliminating danger of gears slipping and making possible easier and quicker speed changes without loss of acceleration or momentum to the locomotive and load, it is claimed. The transmission case is enclosed, and protected from dirt and grit.

The manufacturer states that this locomotive has sufficient power to slip its wheels in first and second speeds, and the rated drawbar pull under normal conditions will be as follows in each speed: 2 m.p.h., 4200 lb.; 4¼ m.p.h., 3500 lb.; 7¼ m.p.h., 2500 lb.; 10⅛ m.p.h., 1725 lb.

Like all other Vulcan gasoline locomotives, this machine follows the general lines of the Vulcan steam locomotives. The frames are of the open-hearth cast steel, locomotive-bar type; the bumpers of heavy section cast iron, with separate coupler pocket castings; axles of high-grade forged steel; wheel bearings of cast iron, bronze lined, with removable collars; springs of the heavy coil type. Wheels are connected by forged steel side rods as in steam locomotive practice. The cab is of steel, fully enclosed, with sliding doors at rear and windows all around. The operator sits in the cab facing forward, and all levers, pedals, switches, and buttons are arranged for easy manipulation.

The specifications show the following equipment: Waukesha model D. U. (bus) motor, developing 60 hp. at 1400 r.p.m with Splitdorf magneto and Westinghouse self-starter and electric lights (both ends);



Seven-ton worm-gear-drive gasoline locomotive class I.G.S. The cast steel bar type frames and forged steel side connecting-rods are the same as in steam locomotive practice

Stromberg carburetor; Willard storage battery. The radiator is of the tubular type.

One of these models will be on exhibition at the Good Roads Show, Chicago, from January 5 to 9.

A 15-Ton Locomotive

The Milwaukee Locomotive Manufacturing Co. of Milwaukee, Wis., has added to their line a new and larger model of their type "H" gasoline locomotives, which is described by its manufacturers as follows: "This locomotive is known as the type "H" 15, a 15-ton machine which is furnished for all track gages from 30 to 56½ in.

"Like the smaller sizes of this type, it has gear and chain drive with 4 speeds of 2, 4, 6 and 12 miles per hour, both forward and reverse.

"The entire power unit is mounted on a substantial sub-frame, insuring rigidity and perfect alignment. The construction of the sub-frame is such that the entire power unit may be easily and quickly removed from the locomotive proper when necessary.

"The locomotive is powered with the very latest and advanced type of six-cylinder engine, having a 5¾ in. bore, and a 7 in. stroke, especially designed for heavy duty service and capable of developing 115 h.p. at 1000 r.p.m."

"The engine is equipped with a maximum speed regulating governor which prevents the running of the engine above the normal speed of 1000 r.p.m. It is also equipped with a 2 spark high tension magneto and impulse starting coupling.

"The carburetor is a Wheeler-Shebler model 'AT' with low and high speed adjustment, especially adapted to the needs of heavy duty engines.

"The engine is also equipped with an automatic air cleaner and has forced water circulation and forced feed lubrication.

"A multiple-disc clutch is used, the clutch having ten driving discs and eleven driven discs.

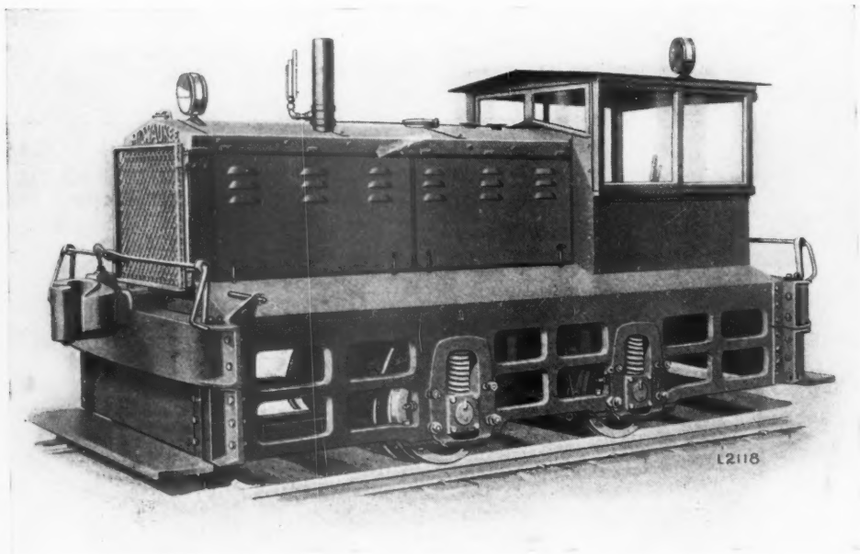
"The transmission is of the jaw clutch and gear type and provides 4 speeds of 2, 4, 6 and 12 miles per hour both forward and reverse. In this transmission the gears are always in mesh, the design being such as to eliminate all possibility of stripping the gears.

"The very highest grade of chrome vanadium steel roller chains, having a tensile strength of 95,000 lbs. are employed to transmit the power from the transmission drive shaft to the axles.

"The brakes are of the conventional, hand operated, four-wheel spread type, but straight air or automatic air brakes can also be furnished when specified.

"The sanders are hand-operated, the sander box being located under the hood where the heat from the engine has a tendency to keep the sand dry and free running.

"This locomotive is equipped with a 12 volt electric lighting and starting system, consisting of generator, starter and Westinghous storage battery."



New 15-ton gasoline locomotive mounted on a very substantial sub-frame to insure rigidity and alignment

Fordson Units

In the field of smaller gasoline locomotives the Fordson tractor adaptations continue to hold their own. A typical installation of the Adamson locomotive built on a Fordson tractor by the Adamson Motor Co., Birmingham, Ala., is illustrated herewith.

The Miami Fordson scraper, a combination of a Fordson tractor and a 2-wheel all-steel scraper excavator, was described in Rock Products, January 26, 1924. There are, undoubtedly, many uses for a tractor about a plant. We believe there are numerous instances where tractor and scrapers could be used economically for stripping.

Adaptation of a tractor for quarry use

Purchasing Quarry Cars

The following quoted paragraphs have been contributed by a leading industrial car manufacturer who builds all types of cars and has made a study of quarry cars extending over several years. He writes:

"If nature or the powder man could deliver broken stone at the quarry face all of the same quality and size, it would be possible to standardize on a type of quarry car and vary the capacity to suit the tonnage of the plant.

"Where the stone, through natural causes or otherwise, is thrown down comparatively small and uniform in size, it can be loaded by hand or steam shovel into cars relatively light. Hand-loaded cars of small size, capable of being pushed by one or two men or drawn by a horse, give good results, or even larger capacity light cars—cars of four or even six or eight tons—will stand up under shovel loading without abnormal expense under some conditions.

"There are, however, quarries, and many of them, where the stone is hard and strong or where it breaks up into irregular, rough and large pieces; where hand loading is unecenomical or impossible; where the primary crusher will take any stone the dipper can lift and the shovel is a large one. In such quarries much money is lost through the use of inadequate and poorly designed cars.

"These conditions render it incumbent upon the quarryman to inform himself about cars used elsewhere and to bear in mind that the low price car is not always a good investment. A prominent quarry operator, in a recent article, says that 'Any car of the rocker dump or "contractor's type" when used with a steam shovel will not be durable—the loading of the stone will destroy the body.' We believe he is right.

"The V-body, both side-dump, steel car is a standard product in small sizes and therefore has an appeal on account of first cost, it properly belongs in the hand-loaded class, but through familiarity has been used in shovel-loading quarries. No quarry car is durable under steam shovel loading where the body is only supported by rockers (points at each end of the body)

as in the rocker-dump car, or by a series of two or more pivots in a line along the center of the bottom as in the 'contractor's type' car.

"The 'contractor's type' car followed the contractor into the quarry. Like the steel V-dump car its manufacture in large quantities lead to a low ton or yard capacity price, and its abundance in the second-hand market makes it 'an attractive buy'. It fills the need of a car for handling loose, excavated material to be dumped at various points, but inadequately meets the requirements of quarry service. The 'won-way' car demonstrates the notable improvement which can be made by supporting the bottom of the 'contractor's type' car, with little or no other change.

"Another quarryman says, speaking of large operations 'of course the steam-shovel engineer is not supposed to drop the stone three or even one foot, but sometimes they do so with disastrous effect. Few appreciate the perverse, ingenuous, diabolical destructiveness of a careless shovel operator'. The axles under this quarryman's cars had 50 per cent more carrying capacity than would be used under a freight car to haul the same load. They broke, and the new ones were made with 150 per cent more capacity.

"The quarryman does not acquire overnight the knowledge to purchase intelligently a good quarry car nor does the manufacturer learn how to build good quarry cars, if his knowledge be limited to the cars built in his own shop. Price will always be the only consideration when two such uneducated traders meet. Few quarries do or can employ experienced car designers; there may be a draftsman or two, but these know little of the cars used in other quarries.

"One superintendent had never visited a quarry a mile away and knew nothing of the car equipment. The average inquiry only specifies the capacity, whether side- or end-dump and gage of track. Owing to distance and limited time the manufacturer, knowing nothing of conditions, bids on his cheapest and lightest design feeling that price will be the deciding factor. The other day a new quarry placed an order for $20,000 worth of cars; their consulting engineer, whose word was final, said to one of the bidders: 'We are not interested in and have no time to consider your design of car—what's the price—*price* is the deciding factor.'

"The average buyer holds in no confidence a blueprint or specification accompanying a bid, he may cover up or erase the price quoted, or cut the title and manufacturer's name from the manufacturer's blueprint—but too often the selected specifications and drawings are given to the less competent bidders to figure on. Yet these same specifications and blueprints are the result of years of close study and development and constitute the manufacturer's good will.

Comparing Problems and Experience

"In the past there has been little or no spirit of 'Let's get together and talk over what is best for our conditions'. Little good would have been accomplished by so doing, for until recently the quarryman knew only the cars in his own quarry and the manufacturer only cars *as they left* his shop.

"It is fortunate that a means is at hand and has been in operation for several years to correct these conditions. Quarrymen have been meeting together yearly at the conventions of the National Crushed Stone Association and through interchange of knowledge at these meetings are more discriminating and intelligent buyers. By a wise provision for a class of associate membership, composed of manufacturers of equipment and material used by quarries, an opportunity is given at these conventions for the quarryman and manufacturer to meet outside the bounderies of the sales and purchasing departments. Confidence is being established between buyer and seller and there is free interchange of ideas as to needs and products. There is taking place a steady improvement in all equipment for quarries."

Stronger Two-Way Dump Cars

Wm. D. Foulke, treasurer of the Western Wheeled Scraper Co., Aurora, Ill., sees an increasing use of two-way side-dump cars in quarries, and his company is devoting much time to strengthening this type of car, overcoming previous objections to its use. Some of these improvements he describes as follows:

"In Western cars of 4-yd. and 5-yd. capacity the center bed sill has been lengthened and the ends braced with gusset plates. In the Western 6-yd. car two 4-in. Z-bars have been substituted for timber in the center sill and gussets have been added. In the Western 12-yd. car the center sill now is made of 6-in. Z-bars.

"The 4-yd. and 5-yd. Western dump cars are built for 36-in. gage track. The 6-yd. Westerns are standard gage. For this reason the 6-yd. size is greatly in demand. It is the smallest standard gage two-way side dump car made and its use enables a growing concern, desiring to increase production, to install larger cars without making expensive changes in the track lay-out."

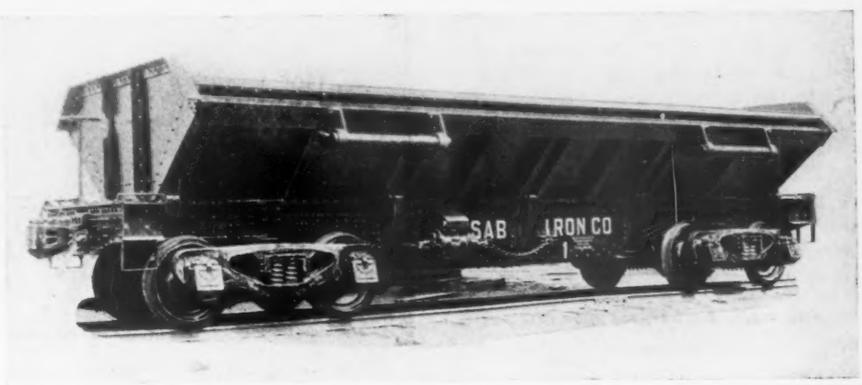
New All-Steel Quarry Car and Dumper

The Atlas Car and Manufacturing Co., Cleveland, Ohio, has recently built an all-steel car and special dumper which demonstrates the tendency towards more rugged and permanent transportation equipment on the part of some of the larger producers. It is described as follows:

"This car consists essentially of a truck or frame which is mounted in the usual way on extra heavy wheels and axles with heavy journal bearings and spring pedestals to protect the equipment. The body or hopper of the car is made of an entirely separate unit of extremely heavy construction. It rests directly on the framework when carrying the load, but when the car reaches the dumping point the hopper is tilted so that the contents can easily slide out, generally into the chute to the crusher.

This construction has important advantages. In the first place there are no moving parts or mechanism to get out of order. The hopper is simply dropped in place and automatically held by suitable blocking. When it is tilted a hoist of some type is used, but there is no machinery on the car. It will be obvious that this is a wise arrangement in view of the fact that ordinarily but one hoisting rig is provided for a large quantity of cars, and aside from the annoyance and cost of maintaining dumping mechanism on all the cars, it is far simpler and certainly far cheaper to have but one dumping station which can and does receive the proper attention at far less cost than all the cars could be maintained.

"An additional advantage is that in case any of the hoppers or bodies are damaged by the fall of large rocks, it is a very simple matter to throw the damaged body



All-steel quarry car with special dumper

aside until it can be repaired and replace it with a spare hopper. The entire design of the car lends itself particularly well to rigid construction.

"On the iron ranges it has been generally the practice to use air-operated side-dump cars and every operator knows that these are very difficult and expensive to maintain. It was concluded that the type of car which was found satisfactory for quarry service would also be very satisfactory for heavy range work, and illustration shows a 70-ton capacity car developed particularly for this service, which is rugged enough to stand the most severe abuse.

"In order to handle this large capacity car a special form of dumper was necessary and The Atlas Car and Manufacturing Co. finally designed and built the dumper shown, which operates very satisfactorily.

"The particular feature of this dumper is that the operator has absolute control of the dumping hopper at all times, as the hopper is rigidly connected to the dumping device in such a manner that the hoist can be stopped at any point or, if necessary, the hopper can be shaken in order to loosen any material which should happen to stick in the hopper.

"The operation of the hoist is as follows: The loaded car is brought into position in front of the hoist and the operator starts operation by hoisting the two trolleys to which the dumping arms are connected. These dumping arms automatically lock to suitable trunnions on the car hopper and as the trolleys are hoisted the body is forced up and over to the dumping position, but always under absolute control of the operator. Replacing the body simply means reversal of these operations."

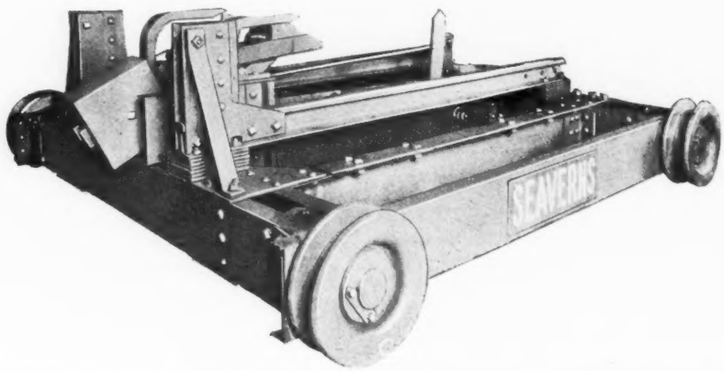
Special form of dumper for large capacity cars

Automatic End-Dump Car Dumper

The James B. Seaverns Co., Chicago, Ill., announce the manufacture of the Seaverns patented automatic quarry-car dumper which is designed "for installation in quarries using large crushers, such as 18's, 21's and 24's, where plant owners operate with large shovels and the latest improved equipment.

"The narrow or standard gauge track is mounted directly on the car dumper 10-ft. gage, which travels up with car a distance of 8 or 10 ft., leaving a clear space immediately behind the car above the crusher for end-dump cars to discharge stone into a clear opening about 10 ft. square without striking rails or supports. There is no time lost in trying to shoot out large chunks of rocks which lodge between the rails or in repairing broken rails and stringers where these car dumpers are used.

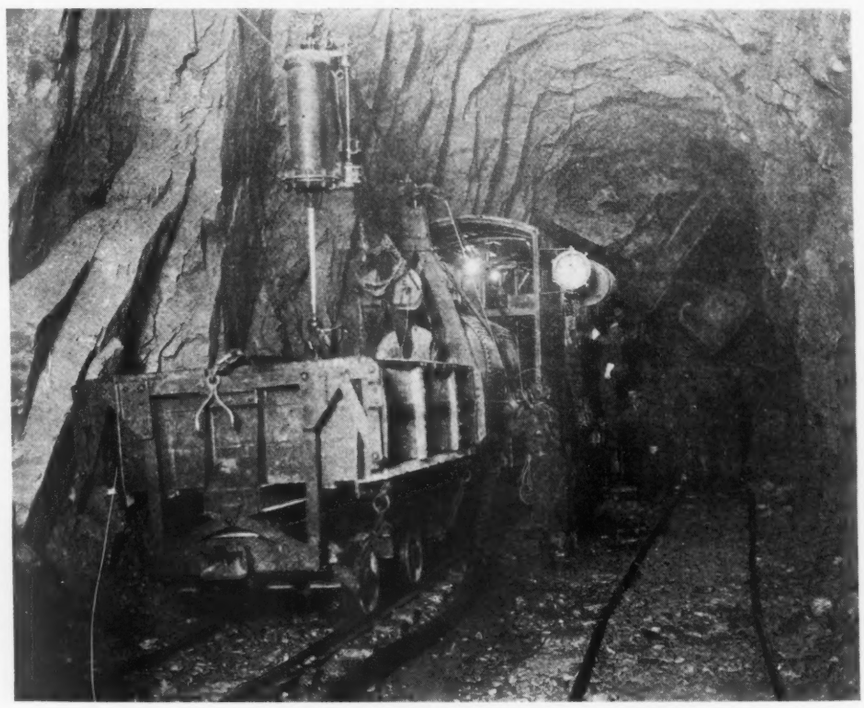
"The dump car so interlocks with the car dumper that it is impossible to have the two separate during the course of operation, thereby making it absolutely safe and reliable. These cars are built of structural steel having large shafts, roller bearings and double flanged cast-steel wheels. No additional power necessary to operate these car dumpers."



Automatic car dumper designed for use in quarries using large crushers

Track Scales

Demand for greater accuracy and refinements in scales has changed the manufacturing process from one of foundry practice to machine shop methods, according to A. E. Ashcraft, general manager of the St. Johnsbury, Vt., scale plant of Fairbanks, Morse and Co. He points out how the Fairbanks-Morse scale plants are meeting the requirements of the field. Plate fulcrums instead of knife edges for track scales, machined pivots and stands, and the developments of new dial and beam types are some of the instances mentioned.



Interesting solution of a transportation problem in connection with work of air-operated shovel (see page 147). The air hoist lifts the car from one dead-end track to another

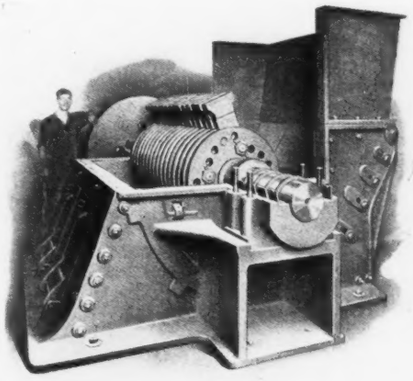
Crushers and Pulverizers

THE past year has seen no startling innovation in the way of a new crushing or pulverizing machine, but has seen several improvements in the standard forms of these machines. One change of importance in a business way should be recorded, the purchase of the crushing and cement machinery line of the Worthington Pump and Machinery Co., including the well known Mccully and McCully Superior crushers by the Allis-Chalmers Manufacturing Co. The Superior McCully reduction crushers are now made in two sizes, 6-in. and 10-in.

The Allis-Chalmers line of Type N crushers has been considerably improved during the year, the principal improvement being the mounting of a two-stage centrifugal pump on eccentric which makes the oiling system entirely self contained, doing away with outside piping, geared oil pump, strainer and other parts. Improvements have also been made in the self tightening device for the mantle, so that now the crusher will run equally well in either direction. The dust proof features of this crusher have been made more positive.

During the year the Allis-Chalmers Manufacturing Co. has designed and equipped a number of plants, one of which is described in this issue.

Hammer mills are growing in favor, the use of a single machine for reducing from quarry run to commercial sizes appealing to many operators on account of the simplicity of the plant. The Williams Patent Crusher

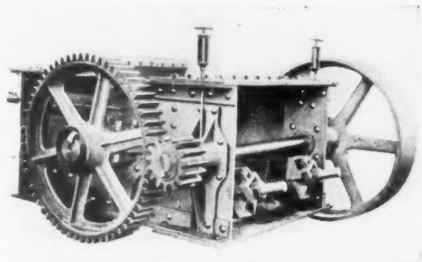


Immense hammer mills now used as primary breakers for limestone

and Pulverizer Co. has improved its Mammoth crusher, the No. 9 size, of which will take a 48-in. cube rock, by putting in a new front end for holding the breaker plates of steel construction and heavily reinforced. A special type of hammer has been developed for this machine that has proven effective in reducing the amount of fines made in crushing. This crusher will reduce from 48-in. cube to 1½-in. ring in one operation.

The Jumbo and Jumbo Jr. sizes of this crusher have also been improved in design, and the line now includes machines that can be adapted to all sorts of quarry loading, the smaller sizes being adapted to receive 16-in. pieces, or one man stone.

The Pennsylvania Crusher Co. says that it feels that a real forward step has been made in one branch of primary crushing by the introduction of its Armorframe single roll crusher. This has a heavy fabricated steel frame which is rigid and practically unbreakable. It may be applied to steam shovel or hand loaded stone, the product in the first case being from 6 to 8 in. in size



Single-roll crusher with "Armorframe"

and in the second case from 3 to 4 in. and finer.

The limitation of this type of crusher is that it is not adapted to the harder rocks, but on ordinary limestone, gypsum and similar rocks it is claimed to have advantages over other forms of crushers in that it will take choke feed without danger of blocking and will handle wet and sticky feeds without other effect than a slight decrease in capacity. The feeder action of the roll is important in providing a steady feed to the plant and there is no danger of the elevators and conveyors being flooded.

The Pennsylvania company has also applied the steel frame construction to its "Steelbuilt" hammer crusher for the production of agricultcral limestone. This machine is now built so that the entire cage may be moved closer to or farther away from the hammers without stopping the operation of the machine. In addition it is amply protected against tramp iron by a pocket in the rear in which tramp iron is trapped and removed perhaps once a week.

The Smith Engineering Works, Milwaukee, Wis., has made some important improvements in the manufacture of its Telsmith crushers and the latest machines of this type are built almost entirely of steel. Although the earlier types were fully guaranteed against breakage, the company states that they have found that a large percentage of crusher users in both the mining and rock products fields are willing to pay a substantial premium for all-steel construction. Some notable descriptions of Telsmith installations were mentioned in Rock Products during the year, for example the Graham Bros. crushing plant on Catalina Island, Calif., in the issue of February 23. Telsmith crushers are used as secondary crushers in this plant, following a large jaw crusher. The new rotary grizzly and Telsmith plate feeder which were introduced by this company in 1924, are described in other sections of this review.

The Traylor Engineering and Manufacturing Co., Allentown, Penn., says that the "Bulldog" finishing crusher, which was first announced in the machinery review of Rock Products' annual review number for 1923, is increasing in popularity with crusher users. This is due to the demand for a crusher which will produce large quantities of ¾-in. to 1¼-in. stone at a minimum cost, which this machine was especially designed by the manufacturers to do.

The Universal Crusher Co. of Cedar Rapids, Iowa, makes a full line of crushers, including hammer mills, but it is especially well known in the gravel industry because of the special crusher that it makes for crushing gravel. The business of this company has so expanded during the past year that it has been compelled to seek larger quarters, and it has built a new modern factory and office building into which it moved about the middle of the year.

Fine grinding machinery has been developed remarkably in some ways during the past year. Perhaps the most noteworthy advance in mills of the revolving type has been made by the Hardinge Co. of York, Penn., in the adoption of an air classifying system to the Hardinge conical mill. This is described here rather than with the air separators because the classifier is directly connected to the mill and revolves with it.

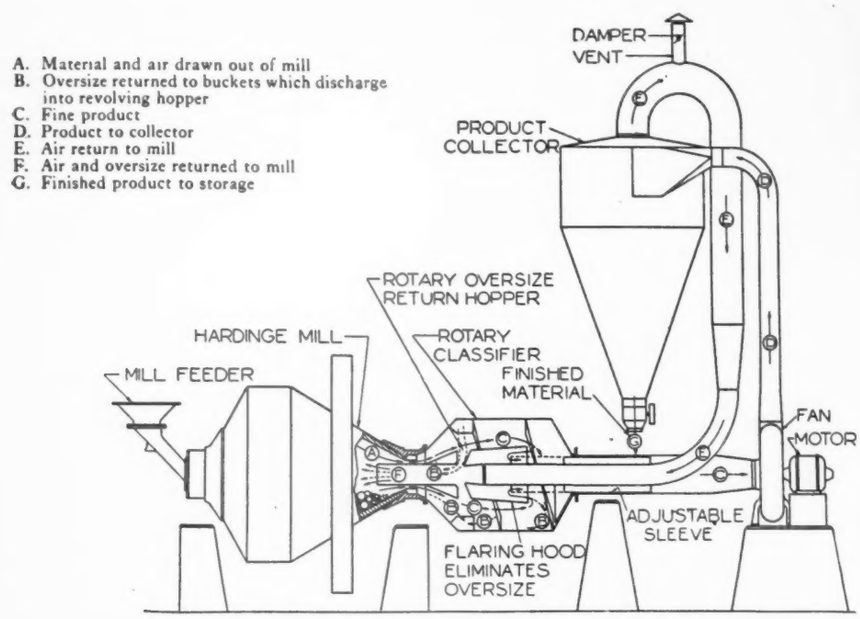
The classifier is the result of four years of study and experimentation on the part of the Hardinge company. It has two new features in separators of this type; it applies the principle of reversed air currents and, being directly connected to the mill, it does away with the necessity of conveyors and elevators to handle the product.

The following description of the classifier and the way in which it works has been furnished by the makers:

"The rôtary classifier is attached to the discharge end of the mill. Air is drawn through this discharge end by the exhauster. As the mill rotates, this current stirs up the material and the finer particles as they emerge from the discharge end, are carried through the classifier directly to the finished product bin. Due to the low velocity in the classifier, any oversize that discharges into it settles out and drops on the shell. While the finished product is carried through to the storage bin, the oversize is conveyed by an helix attached to the shell of the classifier back to small buckets which lift and drop it into a hopper, where it is blown back into the mill by the air current returning in the inner pipe. This current returns with such velocity that it blows the coarse oversize back into the main grinding zone of the mill, where the grinding and classifying

action is repeated. Regulation of fineness is secured by moving the inner sleeve of the discharge pipe backward or forward, which action results in a fairly abrupt change in direction of the air current.

"The rotary air classifier produces a product of approximately 98% passing 48-mesh and 80% passing 200-mesh, or coarser if desired, and the rotary and superfine classifier, which is an amplification of the rotary, meets the most severe specifications as to fineness. Adjustments may be made to obtain any desired product from approximately 75% through 200-mesh up to 98% through 325-mesh. The finer the product, of course, the smaller is the capacity of the grinding unit.



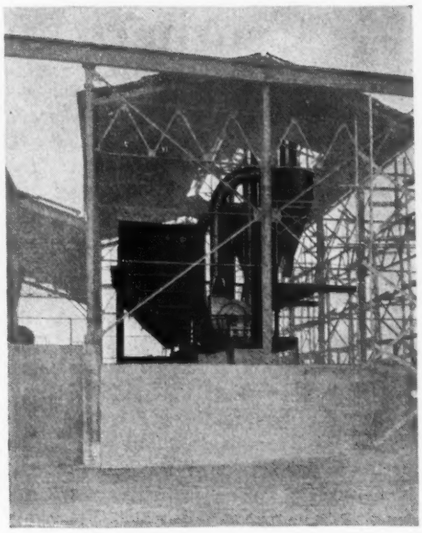
New type of closed-circuit, air-separation, fine-grinding unit

"Capacities, of course, vary with the size of the mill and the nature of the classification. The rotary ranges from 400 or 500 lb. an hour, with a 2-ft. mill to 35 tons an hour with the 10-ft. mill. The superfine range is, roughly, between 300 lb. an hour with the 2-ft. mill and 23 tons an hour with the 10-ft. mill."

The Raymond Bros. impact pulverizer, Chicago, has placed the super Raymond roller mill in the fine grinding field during the past year. These have been adapted to the pulverizing of coal, a noteworthy installation being that at the Cahokia electric power station at St. Louis, which is perhaps the largest steam electric generating plant in the country. The manufacturers write of this installation as follows:

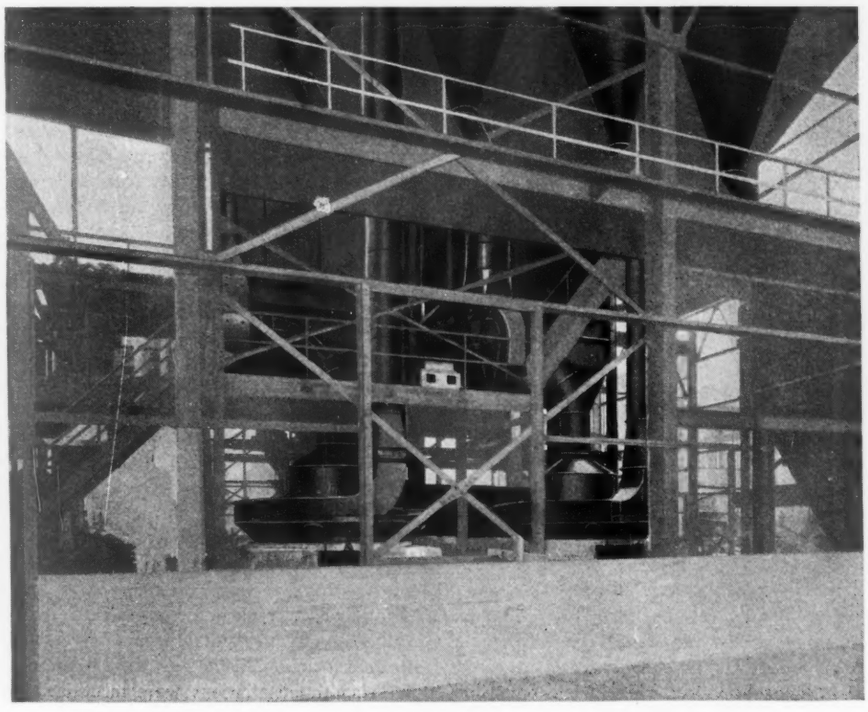
"These machines are the largest that have ever been used for pulverizing coal. Their capacity is rated at 15 tons per hour on an average good grade of bituminous coal to a fineness of 95% passing a 100-mesh, which is suitable for firing rotary kilns in cement plants. The capacity is not exaggerated, as we have one of these super mills which has been in operation at the East St. Louis plant, Cahokia station of the Union Electric Light and Power Co. of St. Louis, for about six months. Average capacities produced on a partially dried coal, containing from 4 to 6% of moisture, runs 16 to 17 tons per hour to a fineness between 85 and 90% passing a 100-mesh. This coal, of course, is much harder to grind because of the moisture content than dried coal.

"Twelve of these super Raymond roller mills have now been built and are being installed in other power plants."



Super-Raymond mill installation at Peerless Portland Cement Co. plant

The Bradley Pulverizer Co., Allentown, Penn., has made a great many installations of its Hercules mill in many of the cement plants that have been built during the past year. Eight of these were put in the plant of the Universal Portland Cement Co. at its Universal, Penn., plant, in which there is one of the largest clinker grinding plants in the United States. Among other notable installations were those of the International Cement Co. of Argentine and Uruguay. The company writes that it has made a number of improvements in this mill during the past



Another view of the coal-grinding mills of the new Peerless Portland Cement Co. plant at Detroit, Mich.

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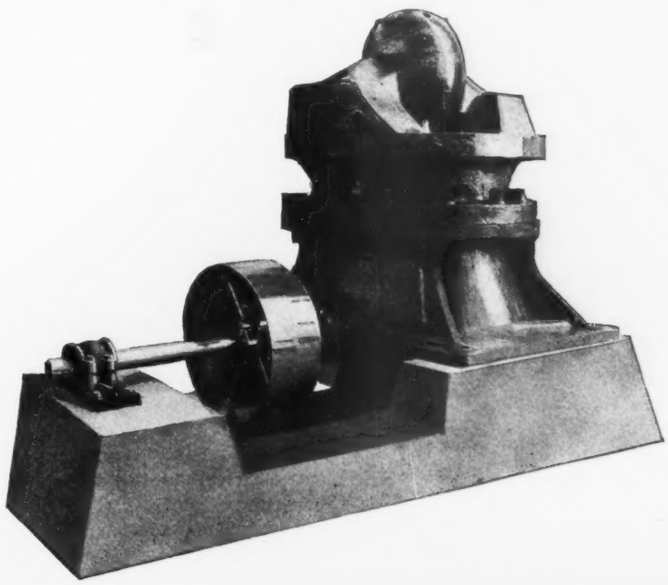

New finishing crusher of the "Bull-Dog" type

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Conveyors and Elevators

THE advance in conveying and elevating machinery in the past year has been along the lines of ordinary development; that is to say, that no unusual devices or exceptional features have appeared. An exception to this might be made in the case of the bucket elevator protector introduced by Doolittle Stephens, Ltd., of Hagersville, Ontario, since this is a real novelty and one that ought to find a wide application. It was described in the issue of February 23 in the Hints and Helps section and is illustrated here. This simple device has been in service long enough now to prove its value and it ought to be widely used.

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Conveyor parts have received intensive study and some important improvements have resulted. The direct drive conveyor has come in, the motor being attached to the gear shaft of the head pulley. In other cases it is the common practice to drive with a higher speed pulley through a speed reducer.

The ball bearing and roller bearing idlers and return rolls seem to be rapidly displacing the older types and their many advantages seem to be coming to be realized. They permit the use of lighter belts and add considerably to the life of the belt. Some manufacturers claim that it is impossible to stop these idlers by dust and dirt working into the bearings. Examples in recent practice were described in the issue of August 23, where an account of the Stearns troughing conveyor (Stearns Conveyor Co., Cleveland, Ohio)

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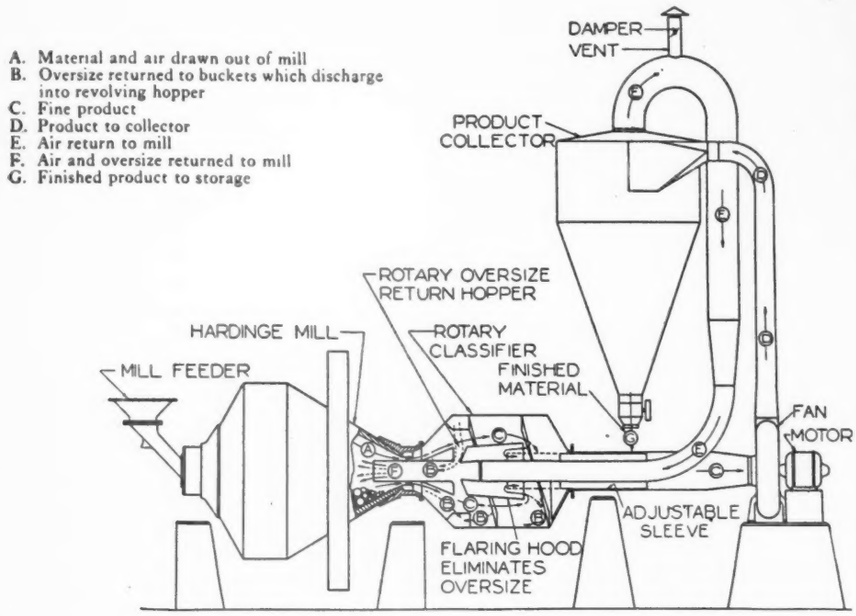

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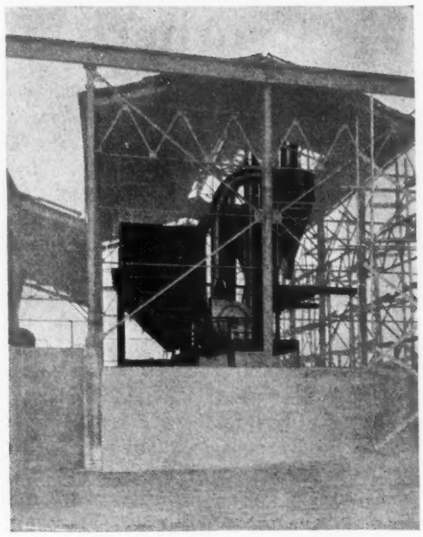

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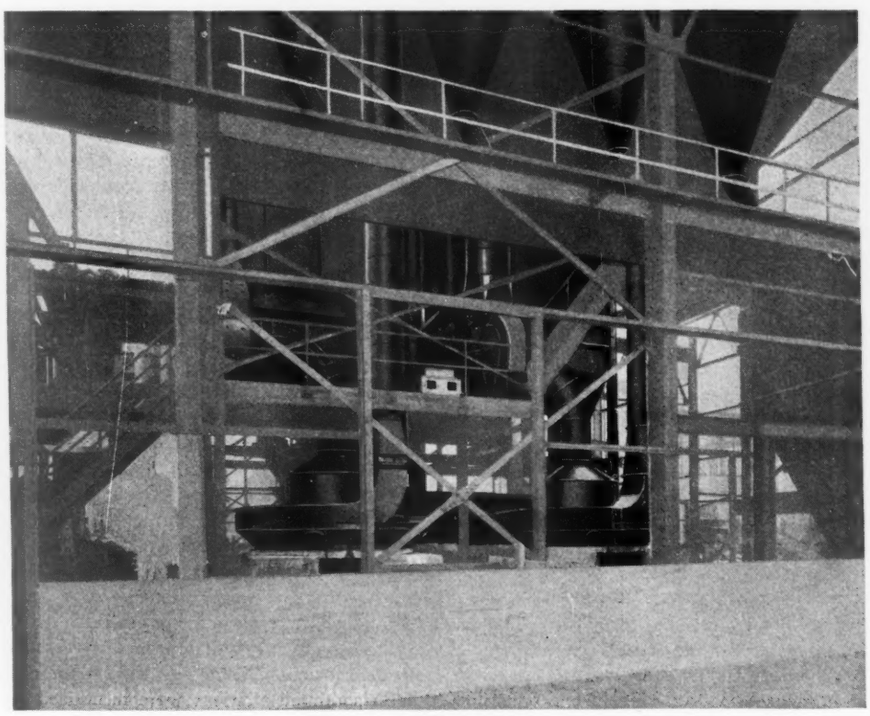

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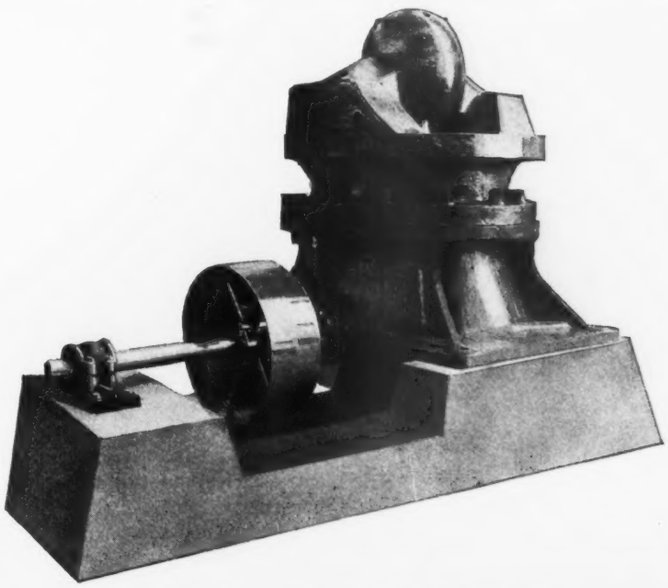

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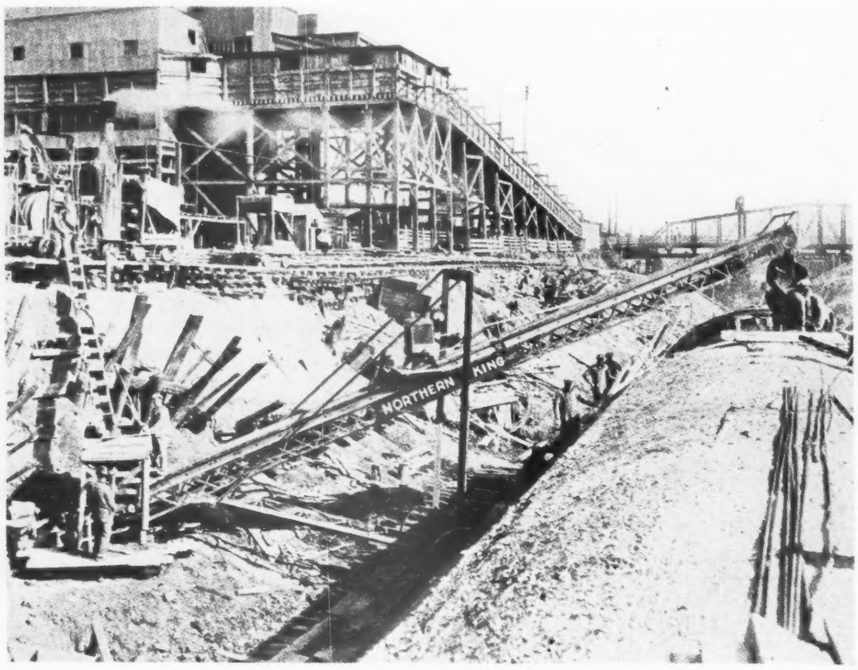
will be found and in the December 15 issue in which the Phillips idler, made by the Variety Iron and Steel Works, Cleveland, Ohio, is described. The latter article is especially interesting, as it describes the evolution of the modern roller bearing carrier, set to conform to the natural curve of the belt, from the simple flat roll first used.

The tendency of present conveyor practice seems to be to use longer centers, which the use of better idlers and return rolls permits. Wider belts naturally come into use as the size and output of plants increase.



Conveyor especially designed to handle concrete

Several notable large belt installations made in the case of the bucket elevator have been noted in Rock Products during the past year. The most remarkable in some ways are the installations made by the Stephens-Adamson Co., Aurora, Ill., at the Graham Bros. crushing plant, Catalina Island, Calif., which was described in the February 23 issue, and another excellent belt installation was that at the plant of the O'Brien Bros. Gravel Corporation, Port Washington, L. I., described September 20. This was made by the Robins Conveying Belt Co. of New York. The 48-in. belt at the Roquemore gravel plant, installed by the Greenville Manufacturing Co., is described in the sand and gravel review in this issue.

Perhaps the greatest progress in the elevating and conveying field has been in the movable appliances in which elevators and conveyors are used, that is portable conveyors and loaders. These were introduced a comparatively few years ago and the original forms, intended for contractors' use, were rather too light for the severe service demanded by producers. Each year has seen these appliances constructed more substantially until some of the later forms ought almost to be included in the excavating devices.

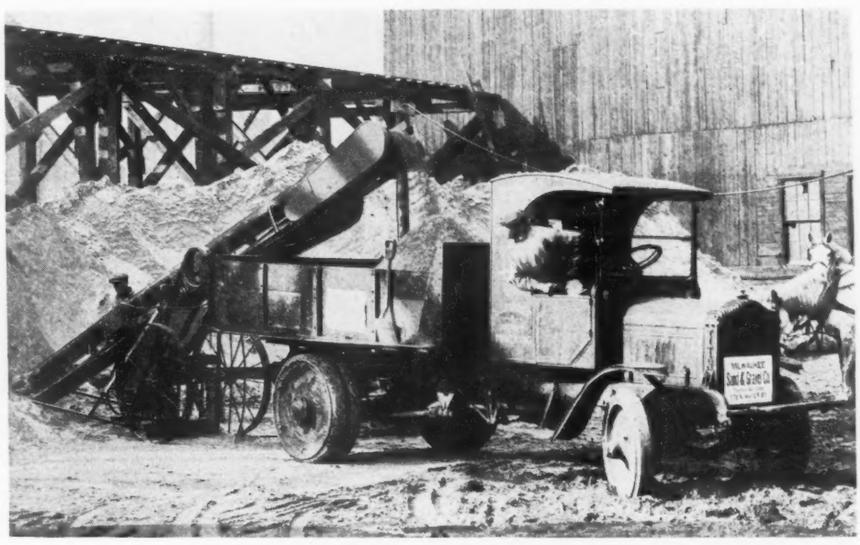
A case in point is the Tanktread loader, made by the Jeffrey Manufacturing Co., Columbus, Ohio, described in the December 13 issue. This is a very substantially built machine which can handle crushed stone up to 3½-in. ring size at a rate of 1½ to 2 yd. per minute. There is a special clean-up device of two revolving spiders, with a safety catch to prevent breakage. The machine is mounted on a crawler tread, the same that is used on "tanks," from which it takes its name, and it has a 50 ft. per minute speed for moving and a 2 ft. per minute speed for digging.

The Ottumwa portable box car loader is another device using elevators and conveyors that marks a distinct advance in machines of this kind. Its unusual feature is that it can be moved from place to place by its own power, the same as a wagon loader. It was described in the January 26 issue.

In portable conveyors some novelties have appeared, one of the most notable being the conveyor made by the Northern Conveyor and Manufacturing Co. of Milwaukee, Wis. This particular type has been especially designed to handle wet concrete with the idea of placing concrete more cheaply than would be possible with men and wheelbarrows, while avoiding the use of wet, sloppy mixtures such as are too often used with the chuting systems. The conveyor is regularly made in sizes up to 100 ft. In the rock products industry it should be an important auxiliary to the wet concrete plants which producers are installing.

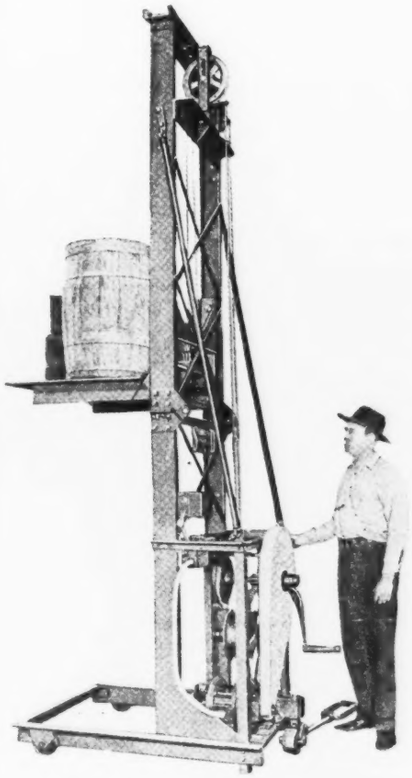
This same firm makes a line of portable conveyors suitable for handling crushed rock and sand and gravel and it specializes in the substantial forms adapted to such work.

The Standard Conveyor Co., North St. Paul, Minn., makes portable conveyors and it also makes a machine which will particularly interest the manufacturers of lime, cement and other rock products that are packed in barrels or bags and which have to be elevated for packing in a warehouse. This is a tiering machine which can lift to any height between 4 ft. and 18 ft. It is made in capacities from 500 lb. to 2000 lb.



A good form of portable conveyor

The machine consists of a pair of structural steel vertical girders which rise



Tiering machine for handling barrels

from a movable steel frame. At the base an electric motor and gearing which move a platform up and down are placed. The platform may be stopped at any height either from the floor or from the moving platform, if the operator is riding with the package. Limit stops hold the platform at the highest and lowest points and there are other safety devices which prevent the platform from falling if the cable breaks.

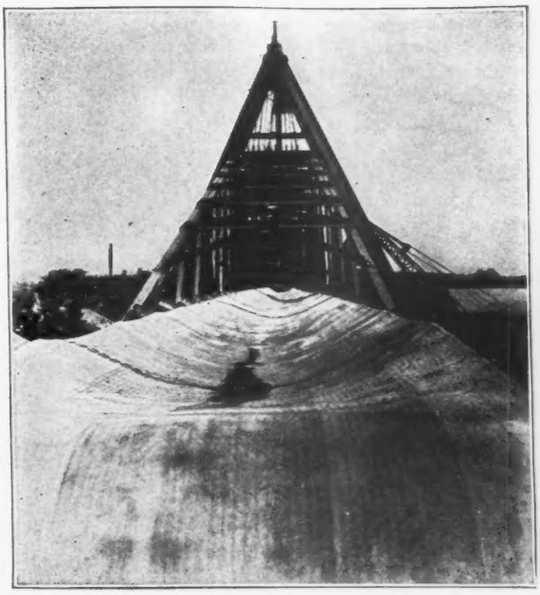
Weights may be lowered, thus reversing the motor so that its acts as a generator and puts power back into the line, a matter of some importance where such a machine is used continuously and is connected with a light or power service.

The machine is made to run by hand as well as electric power, and the hand power machine may easily be converted to use electric power.

In the way of accessories to use with conveyors the Schaffer poidometer, made by the Schaffer Poidometer Co., Pittsburgh, Penn., may be mentioned. This machine, which is used to feed materials by weight, has been described several times in Rock Products. In the past year it has been improved so that its field of use has been widened. One improvement is the use of special heat resisting belts for handling hot materials, and another is the adoption of take-up bearings for tightening the belts.

This machine is now adopted for driving in battery so that it can be safely used for making exact mixtures of different ingredients. Where two or more poidometers are used in this way, any one of these which fails to receive its full supply will automatically stop and at the same time stop the entire battery. As soon as the supply is resumed, the entire battery will resume operations.

Users of conveyors will be interested in an inadvertent test that was made of a Flexco belt fastener, made by the Flexible Steel Lacing Co. of Chicago. This was in a 48-in. belt used to transfer gravel, crushed stone and other materials from a boat by the Cleveland Cliffs Iron Co., Cleveland, Ohio. The belt joint held water perfectly after a rain, as is shown in the accompanying photograph.

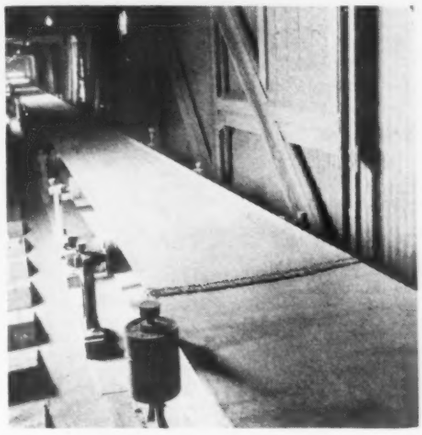


Rain-water test of a belt joint

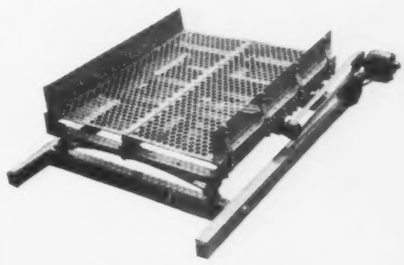
The advantages of being able to make a water-tight joint in a conveyor belt are easily appreciated. Such a joint will not only keep out water but also dust and dirt that might damage the belt and lacing. The well-known Crescent belt fastener is shown as applied to conveyor belts in the cut at the bottom of this page.

Screening and Separation

THE year has seen a considerable advance in screening and separating methods. The vibrating screen which "came back" a few years ago with the introduction of those types of screen in which the fabric was vibrated either by electrical or electro-mechanical methods has appeared in a number of new forms, all of which appear to be meeting with success. Several of these have been described in Rock Products during the past year. The Cottrell vibrating screen was described January 12, a screen vibrated by an unbalanced pulley which the makers claim will screen anything "from sand to boulders." The Link Belt Co. also introduced a screen vibrated by an unbalanced pulley, described March 22. This screen is the product of long study and research and the result is not only a good screen but an excellent mechanism. Its coil spring suspension obviates to a large extent the bad results of vibration. The Sturtevant Mill Co.'s vibrating screen for coarse material



Fastening for conveyor belt



New vibrating screen

was described May 17. This is of a very rugged "skeleton" construction adapting it to heavy duties on damp, dry or wet materials and the shake can be made violent enough to break up "mats" of damp material on heavy tonnages.

New Vibrating Screens

A new vibrating screen not before described in this paper is the Type F screen made by the Universal Vibrating Screen Co., Racine, Wis. This is a mechanical vibrator originally developed to work on slag and coke but found to be equally good for screening crushed rock and sand and gravel.

The mechanical vibrating assembly is mounted below the cloth or plate and thoroughly protected from dust and wear of materials. The weight without motor and driving attachments is 1050 lb. It is 4 ft. 8 in. wide and 6 ft. long.

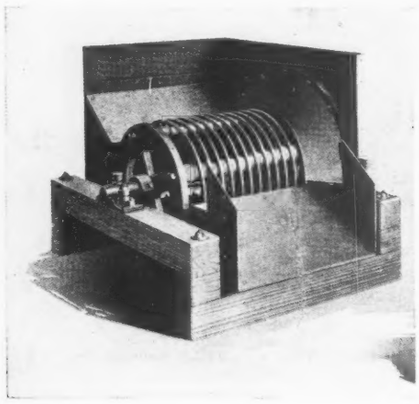
This screen is adapted for use with either heavy wire cloth or punched plate and the makers claim that it is especially adapted to the screening of wet and sticky materials.

The W. O. Tyler Co., Cleveland, Ohio, has introduced a new Hum-mer screen, the Type 39, heavy-duty screen. This was originally intended for the coarsest screening, from ½ to 4-in. material, but it has been found to have a wider amplitude, especially in two-surface work, in some cases the second surface being as fine as 10 mesh.

This Hum-mer has double the power of the standard and will vibrate under any load that can be placed upon it. The vibration may be varied to meet any conditions up to a very powerful vibration for damp or sticky feeds. It is made with an unusually high clearance, 11 in., permitting the largest lumps to pass when working on coarse materials, and it is made in single or double units, set either parallel or tandem, or as a two-surface screen.

Rotary Screens

In rotary screens there have been no especial developments, but a noteworthy feat of rotary screen building was described in the October 18 issue. This was the construction of the largest stone screen ever made by the Harrington & King Perforating Co., of Chicago. This screen was 37 ft. 10 in. long and 9 ft. in diameter and had a capacity for



Rotary grizzly

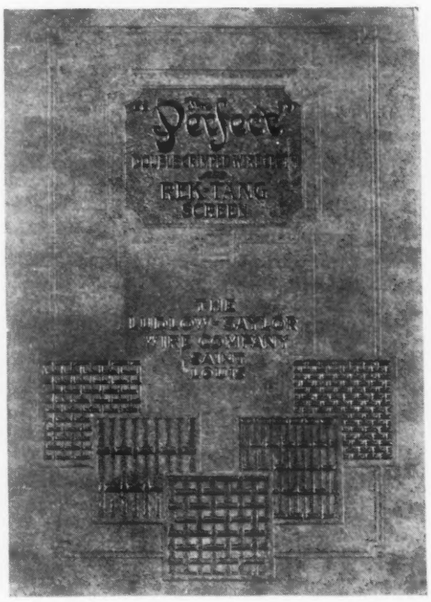
2000 tons of flux stone per hour. Four of these screens were made for one plant.

The same issue carried an account of a new laboratory screen-testing device made by the Sturtevant Mill Co., a neat and simple arrangement for vibrating a nest of screens.

A rotary grizzly has been brought out this year by the Smith Engineering Co. of Milwaukee. This combines the advantages of the grizzly with those of the rotary screen giving increased capacity for the same area. It is shown above.

The manufacture of screen cloth has naturally increased with the increases of the various branches of the rock products industry, and some advances have been made in the technique of the industry.

The Ludlow-Saylor Wire Co., St. Louis, says rightly that the chief advance in the screen industry is the final success of the move to adopt workable standards for testing sieves by the Bureau of Standards, the American Society for testing materials, and the American Institute of Mining and Metallurgical Engineers. The broadening of the series of the Bureau of Standards permits the employment of regular market grades of standard wire cloth and has produced a



This catalog has over 1000 standard screens

series which has bright possibilities for wide adoption.

A second development, according to the Ludlow-Saylor company, is the extension of the wire cloth line to include over 200 new grades. The new catalog of this company lists over 1000 standard square-mesh grades, every grade which has been offered for any purpose in the United States.

The Cleveland Wire Cloth Co., Cleveland, Ohio, which specializes in the manufacture of heavy double-crimp wire cloth, such as is so much used in rock crushers, cement mills, and gravel plants, writes that it has added to its plant so as to increase output 50%.

The Newark Wire Cloth Co., Newark, N. J., has moved into a new and larger plant and has also increased its output, due to the heavy demand from the rock products industries. This company has been making a special study of the wire needed for rock and gravel screens, not only as to making it of accurate diameter and spacing, but also as to its wearing qualities, and they recommend special metals for certain diameters that have been found to be the most economical in service.

This company makes wire cloth for special purposes of monel metal, nichrome, and other special alloys and has even woven wire cloth of tungsten, which is about the most brittle of metals. During 1924 a branch office was established at 66 Hamilton street, Boston, Mass.

Other methods of separation, except air separation, seem to have lagged during the year.

An unforeseen advantage in many cases is the value of the iron recovered in this way. In some cases a ton, or even 1½ tons, of iron is recovered weekly, and much of this may be hammer and pick heads and other tools, as well as track spikes, plates and bolts, all of which are worth sorting out and using again. In slag plants as much as 2% of the feed has been removed as iron and sold to the furnaces. In one plant 15,000 tons of iron was so recovered and it had a value of $8 per ton.

While magnetic separation for the sake of making two or more commercial products is rarely employed in the rock products industries, there is one use of magnetic separators common to all of them. This is the use of magnetism for keeping "tramp" iron and the like out of the crushing machines and the final product. This use of magnetic separators is widespread but it ought to be more widely used than it is. The Dings Magnetic Separator Co., however, reports that the necessity for their machines is becoming more and more understood and that

Magnetic separator with pan conveyor

a goodly number of rock products plants have installed magnetic separators this year.

The cut shows a magnetic separator made by the Magnetic Manufacturing Co., Milwaukee, applied to the head of a pan conveyor which has been quite recently introduced by this company. In its operation it magnitizes the surface of the pan and causes any "tramp" iron to adhere to it during the period that the rock or gravel is being discharged, releasing the "tramp" iron at a point on the return side of the conveyor. It is made to be easily attached to any standard pan conveyor sprocket.

One outstanding feature in the separating field during the past few years has been the demand for finer and still finer material. Five years ago a product testing 95% through 200 mesh wash considered a very fine product, but today manufacturers of paint, rubber, polishes, and many other materials are insisting on products testing 98 to 99.5% through 350 mesh. (U. S. Standard Sieve No. 325.)

This fine separation is well made by air separation. The Rubert M. Gay Co. of New York thus described the action of their centrifugal separator:

"The air, moving at a speed sufficient to support the material, is introduced into a separating chamber where the mass is subjected to a positive rotary motion by means of rotating vanes. The centrifugal force generated causes the particles in suspension to segregate according to weight, following the well-known laws of centrifugal force, the heavier or larger ones being carried to the outside, while the lighter ones remain nearer the center or core of the column.

"The column of rotating dust-laden air moves upward, while the heavier particles move outward, the latter reaching the outside of the column before the light particles reach the outlet in the top of the chamber. The amount of centrifugal force determines the speed at which the heavier particles move outward, and by varying the size, number, or inclination of the centrifugal rotators, all particles larger than the desired size are eliminated from the product carried out of the separating chamber.

"As the relation between lifting and centrifugal force remains constant at every adjustment, speed variations have no effect on the quality of the product.

"More than four years of successful operation on a great variety of materials, varying from 80 to 325 mesh, has proved conclusively that centrifugal separation is the correct and only method of producing uniformly fine products."

The Hardinge air separator, as applied to the Hardinge conical mill, is shown in the crushing and pulverizing section.

Calcining and Drying

PROBABLY the most notable events in cement-kiln manufacturing circles was the entrance into the lists of the Manitowoc Shipbuilding Corporation, and the consolidation of the cement machinery department of the Worthington Pump and Machinery Corporation with the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Early in the year the Manitowoc Shipbuilding Corporation completed its work of installing the kilns, coolers and coal dryer at the new wet-process cement plant of the Manitowoc Portland Cement Co. at Manitowoc, Wis. (See Rock Products, September 6, 1924.)

The layout of the machinery is in accordance with the latest developments toward better efficiency. Results from the kilns are very gratifying to the cement company, yielding a larger output than estimated and burning satisfactorily and economically. Three 10-ft. diameter kilns 160 ft. long were installed.

Air, heated in the coolers, is used for burning in the kilns and the hot gases from the kilns make sufficient steam in waste heat boilers to generate electric power to run the entire plant. Seal rings that work on the kilns and coolers contribute largely to the success of the burning.

A feature of the operation of the coolers is the complete cooling of the clinker, it being possible to pick up the material in the bare hand as it comes from the cooler. The coolers are 8 ft. in diameter by 60 ft. long.

In this connection, recent investigations show that clinker grinds easiest when it comes from the coolers sufficiently cooled to go directly to the grinding mills without storage or weathering of the clinker. This is the process at the Manitowoc Portland Cement Co., where the policy is to store the finished cement rather than the cement clinker.

Steel and concrete construction was used throughout the plant. The Manitowoc Shipbuilding Corporation fabricated and erected the structural steel and bins and also put in all steel walkways, stairs, etc.

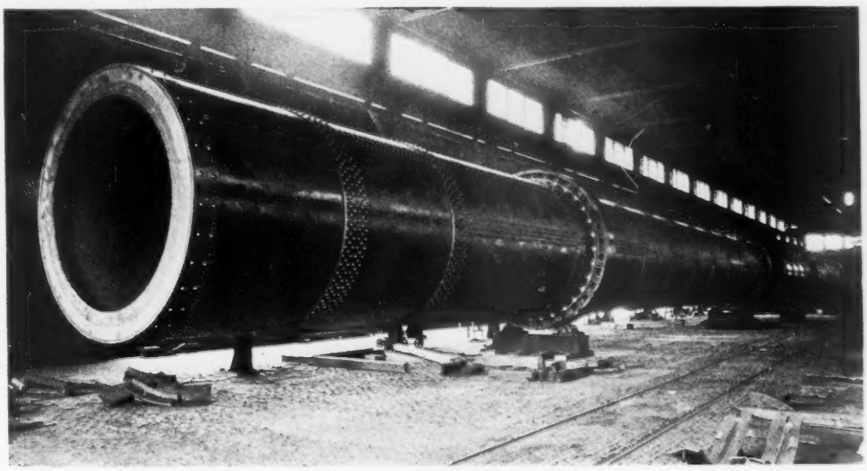
The Allis-Chalmers Manufacturing Co. report many repeat orders from users of their compeb mills and kilns. Their rotary kiln has also been improved by the adoption of the floating type of riding ring in place of rings riveted to the shell. This eliminates loose riding ring rivets. Other improvements in cement machinery have also been made during the year.

The Reeves Brothers Co., Alliance, Ohio, report the installation of what is believed to be the world's largest rotary cement kiln. This is a 10 ft. by 11 ft. 3 in. by 250 ft. rotary kiln, wet-process, which they have built and shipped to the Trinity Portland Cement Co. for their new Fort Worth, Texas, plant.

Meade Improved Lime Kiln

A notable development in lime-kiln manufacture during 1924 was the taking over of the Meade lime kiln by the Vulcan Iron Works, Wilkes-Barre, Penn. This kiln represents the summation of many years' experience in kiln design and construction and lime-plant design by one of the foremost American experts—Richard K. Meade, Baltimore, Md.

This kiln has been designed so as to provide a large storage capacity for stone, to draw easily, and to give a cool lime, when drawn. It has an automatic charging mechanism consisting of a bell and hopper. The bell opens automatically when a car of stone is dumped into the hopper, and closes automatically after the stone has fallen into the kiln. The action is almost instantaneous, and the opening at other times is kept tightly closed. A shield of steel plate prevents stone from getting into the pipe opening. Suction draft, of course, is used. One exhauster is designed to serve several kilns. The rated capacities of a kiln are 14 to 20 tons of lime per 24 hours, depending on the kind of limestone.



This is said to be the world's largest cement kiln

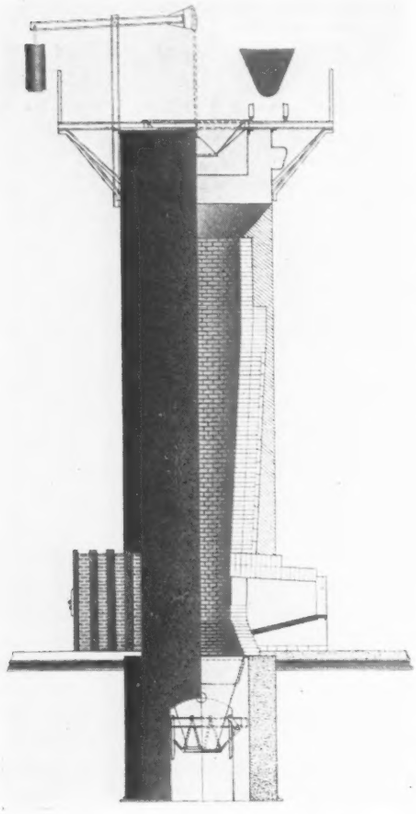
New Rotary Dryer

The J. S. Schofield's Sons Co., Macon, Ga., has just announced a new rotary dryer, which is illustrated herewith. The principal feature of the new dryer is the varying pitch of the helicoidal steel flights which retard the progress of the material at the feed end and hasten it at the discharge end. The furnaces are designed for any fuel and are fitted with a patented air seal at each end to insure full utilization of the heat and maximum efficiency. These dryers are made in standard sizes, 3x20 ft. to 7x60 ft.

Marked Progress in Insulation

The Celite Products Co., Chicago, Ill., announce much progress in heat saving at cement, lime, gypsum and sand-lime brick plants through the use of insulation.

It has been estimated by various authorities that the amount of heat lost through the kiln lining is from 16.3 to 30% of the total



Meade improved lime kiln

heat generated from the fuel. This heat is conducted to the outside of the steel shell and lost into the amosphere by radiaion and convection. In those portions of the kiln which are insulated with "Sil-O-Cel," this loss is cut down 60 to 70%. The "Sil-O-Cel" is laid up in the form of brick between the fire brick lining and the steel shell.

In one 6 ft. 5 in. by 135 ft. kiln insulated with "Sil-O-Cel" brick for a length of 100 ft. coal consumption was reduced from 94 lb. of coal per barrel of cement to 84 lb., a net saving of 10 lb., or 10.63%.

An insulated kiln is also more easily operated, because the blanketing effect of insulation makes possible better and more flexible temperature control, and fluctuations are reduced to a minimum. This results in a more uniformly burned product. The weight of the kiln lining is considerably less, due to the comparatively light weight of "Sil-O-Cel" insulation.

The shell is protected against high temperatures and therefore is not subject to strains and stresses due to temperature changes. Further, the skin temperature is so greatly reduced that much better working conditions are obtained about the kilns. The improved working conditions resulting from kiln insulation are particularly apparent during hot weather.

Of course, kilns are not the only parts of a cement plant where insulation can be used to advantage. It is used in boiler furnaces, waste-heat flue linings, dust chambers and with cooler and clinker-pit linings.

More and more shaft lime kilns are being insulated with "Sil-O-Cel." It is easy to insulate shaft lime kilns by using "Sil-O-Cel" powder as backing behind the brick lining. The lime industry offers an exceptionally good opportunity for savings through the use of insulation. It is estimated that radiation wastes from 16 to 25% of the total fuel fired. Richard K. Meade, well known authority in this field, figures radiation losses from the fire box and kiln shell at 17%. It is claimed that the losses due to radiation can be reduced 60 to 70% by installing "Sil-O-Cel" insulation in the walls of kilns and fire boxes.

Sand-Lime Brick Cylinders

The best method of insulating sand-lime brick hardening cylinders is to apply a 2½-in. course of "Sil-O-Cel" insulating brick on the outside.

The brick are stuck to the shell with "Sil-O-Cel" mortar and banded with tie wires passing around the shell. The insulating brick are covered with wire mesh and two ¼-in. coats of "Sil-O-Cel" hard finish cement. A canvas finish may be applied or the surface may be coated with two coats of "Celcote" waterproofing.

Gypsum Kettles

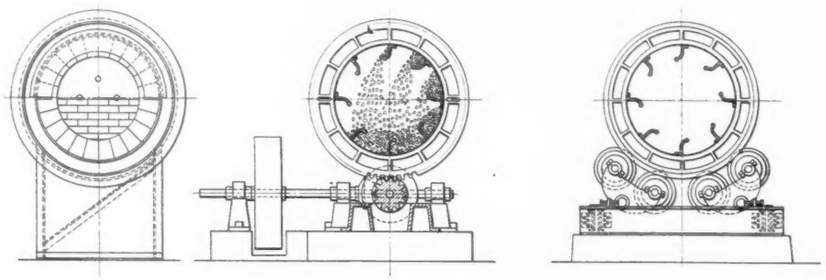
Insulation is applicable to both of the calcining processes in common use in the gypsum industry. It not only results in a considerable saving of fuel but it assists in maintaining uniform temperatures and temperature control.

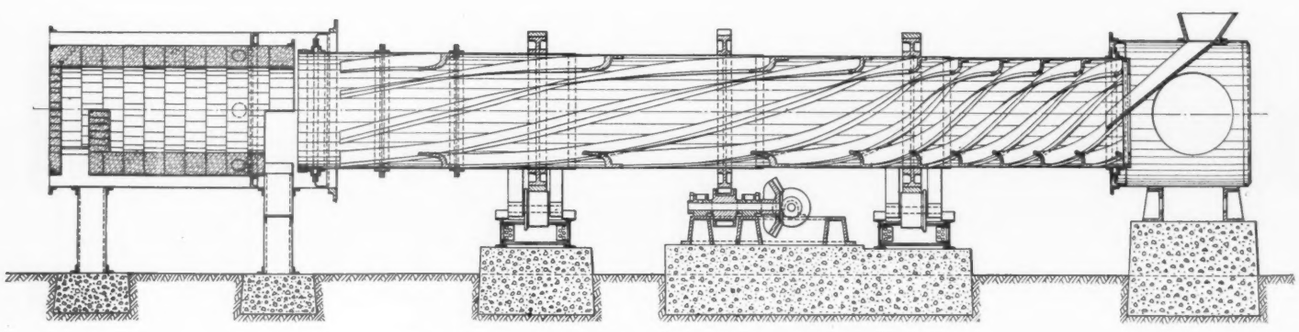
Gypsum kettles are insulated with 2½ in. of "Sil-O-Cel" brick or powder in the side walls, as this is comparatively a low temperature operation. The base is insulated with 2½ in. of "Sil-O-Cel" C-3.

The Celite Products Co. has compiled some valuable literature on the subject of insulation in the rock products industries which may be obtained for the asking.

Big New Coal Mills

The Raymond Bros. Impact Pulverizer Co., Chicago, Ill., have furnished us with views of an installation of two of their Super-Raymond roller mills at the new plant





New form of rotary dryer with helicoidal flights

of the Peerless Portland Cement Co., Detroit, Mich. These mills represent the latest in coal pulverizing machinery. Each has a capacity of 15 tons per hour. A description of this type appears under the heading "Crushing and Pulverizing Machinery."

Lime Hydrators

THE year 1924 saw a number of new wet-process, lime-mortar plants built and put into operation, using the Hay or "Blue Diamond" patented process. The manufacture of the special machinery and equipment for these plants is handled in the East by the Sturtevant Mill Co., Boston, Mass. L. H. Sturtevant has supplied the following information in regard to development in this line:

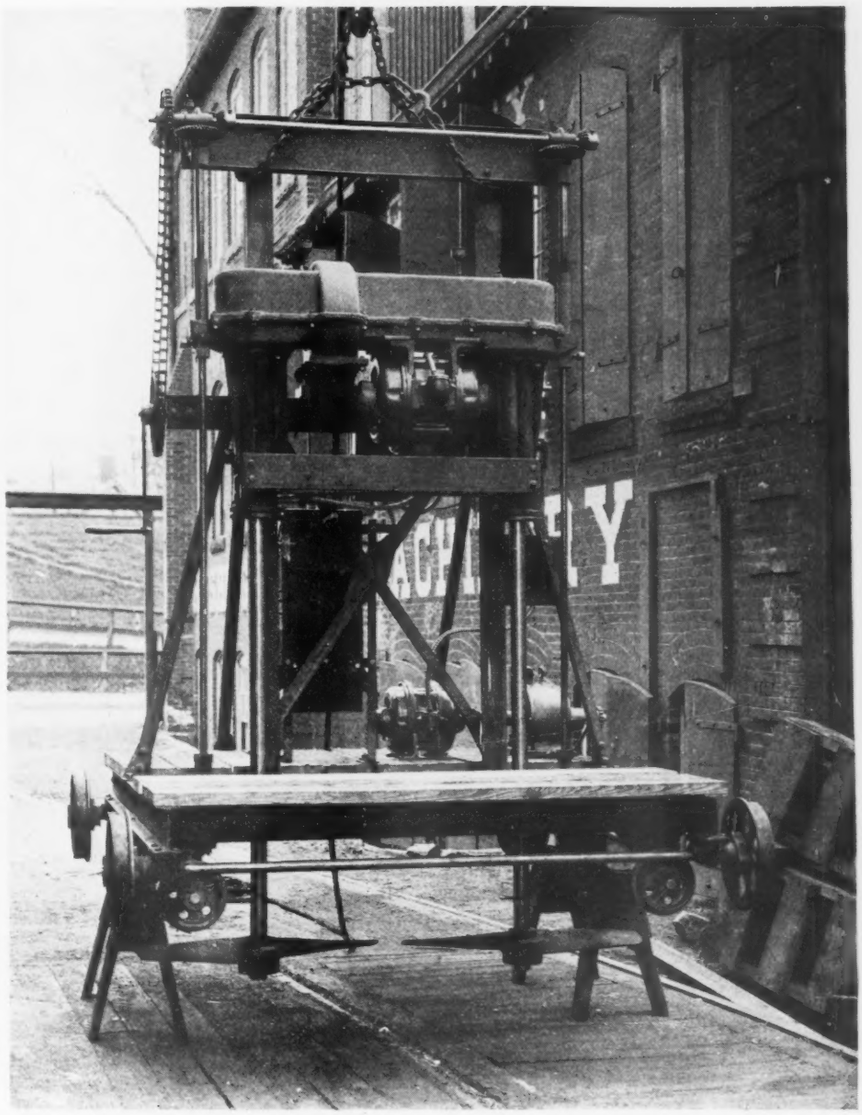
"The raw materials are principally lime and sand, and these are elevated to the top of the plant into storage bins so that gravity carries the raw materials through the necessary steps, with the excepion of the lime putty. After the lime is slaked and screened, it is thoroughly cured in large vats, then it is aerated by a special machine. This particular step is covered by a process patent and has a great deal to do with the success of the Blue Diamond plants.

"By aerating the cured putty, three things are accomplished. First, it makes it possible to transfer the putty to the mixer without any hand labor by means of a special type of pump. Second, it improves the quality of the putty and spreading capacity. Third, the thick, creamy solution produced by aeration insures a much better quality of mortar and plaster, because it is possible to coat the sand grains accurately and produce a uniform, smooth working product. This is practically impossible with a powder or paste.

"The proportions of putty and sand, as well as hair and Keene's cement for plaster are accurately determined in a Blue Diamond plant and it is obvious from the various machines illustrated in this article that the process is bound to be more accurate and positive than the common method of mixing with a shovel and a hoe.

"The finished product in the plant runs into storage hoppers above driveways and motor trucks carry the product directly to the jobs, ready to spread, saving space and trouble on the job, to say nothing of supplying a better product usually at less cost.

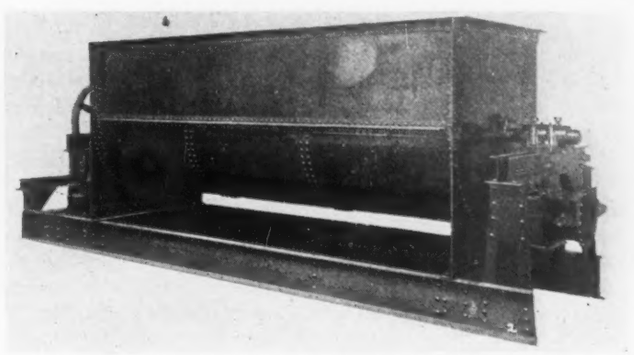
"The Blue Diamond Process has now been demonstrated in enough different locations to prove its practicability under all climatic and local conditions."



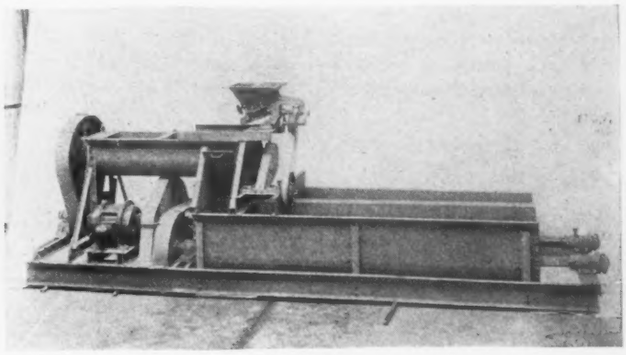
Double agitator for whipping and aerating lime putty

New Lime Hydrators

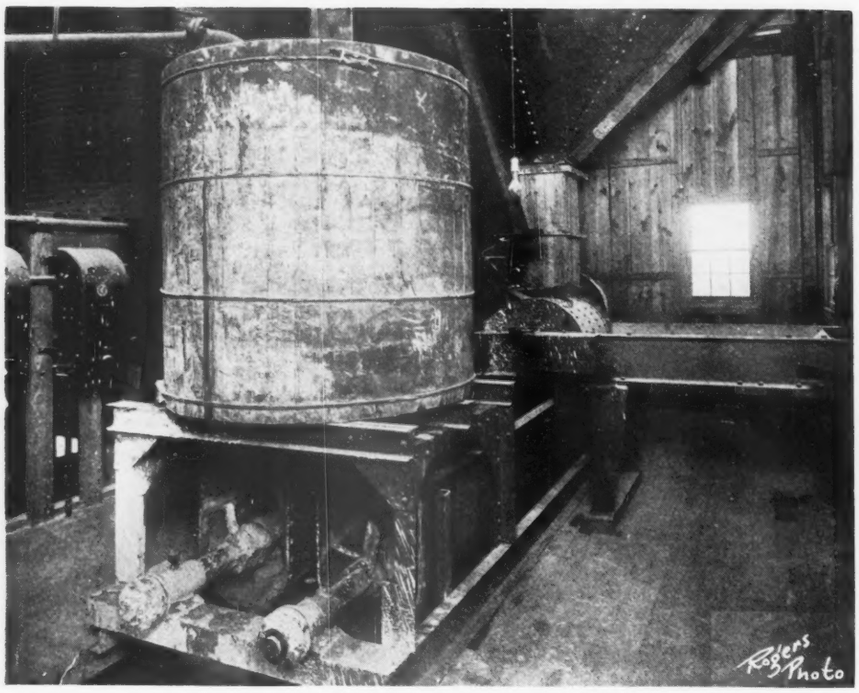
The McGann Manufacturing Co., York, Penn., has recently acquired the American rights to manufacture the Schulthess lime



Batch lime slaker



Double mortar and plaster mixer



Double mixer, hair fluffer, and putty tank

hydrator of Swiss origin, as announced in Rock Products, September 6, 1924. It has recently been discovered that the Limeton Lime Co., Front Royal, Va., had bought one of these machines in Switzerland and has now installed it. Wm. J. Kuntz, vice-president and general manager of the McGann Manufacturing Co., states that he believes this hydrator, which is a continuous hydrator of small capacity, will be a boon to many small American lime plants.

H. Miscampbell, Duluth, Minn., whose "Clyde" hydrators have been installed at many lime plants throughout the world, is completing an installation of a hydrator of new design, and of the continuous type, of which we shall publish more when trials are completed.

Power and Transmission

AS already noted, one of the outstanding developments in the rock products industry during 1924 was the greatly increased use of geared power transmission devices and speed reducers. This has led a number of manufacturers of such devices to particularly study the power-transmission problems of the rock products industries, resulting in benefit to both.

The same is true of the big electric-motor manufacturing companies. During the last year they have given more study than ever to the necessary requirements of motors in cement and crushing plants, and these have led to numerous innovations and improvements.

Industrial Motors

The General Electric Co., Schenectady, N. Y., announce that "a new line of single-phase adjustable varying speed, brush shifting motors was produced having a 2½:1 speed range with constant torque load. They are arranged for interchangeable 110 and 220-volt, and for hand or remote control.

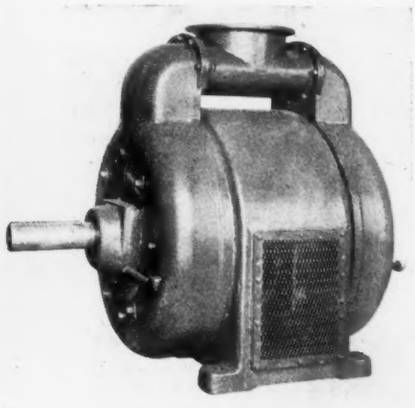
"The line of single-phase repulsion induction motors, utilizing a squirrel cage rotor construction and elminating centrifugal switch, was extended to include the odd frequency motors and the reversing type of motor. The reversing type is capable of reversal from full speed in one direction to full speed in the opposite direction, such as for hoist and crane service, but requires special control in the case of elevators.

"Single-phase motor development also included a line of varying speed repulsion motors designed primarily for direct connection to slow speed exhaust fans. These motors are totally enclosed and have the series characteristics desirable for fan load.

"A new line of synchronous motors for driving air and ammonia compressors employ a double bar squirrel cage winding which permits the designing engineers to have greater control of the current and torque during the starting period of the motor, and in addition permits the motor to be thrown on at full voltage with the assurance of minimum starting current and proper torques.

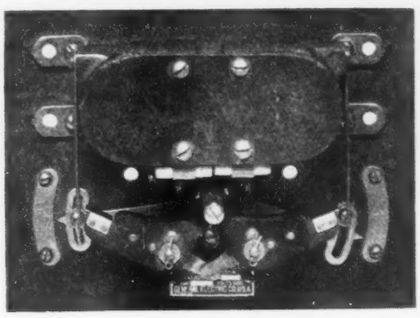
"Among the special motors was a group of 20 induction type units designed for operation in an atmosphere containing one half of one per cent of acetone. All of these motors are of the enclosed ventilated type, taking air in from each end and discharging it through holes in the side of the stator frame near the bottom. The air will be supplied from an external source.

"It is unsafe to operate even the enclosed type of direct-current motor in the presence



Enclosed ventilated type of motor

of vapors from gasoline, ether, etc., and in order to meet better requirements for operation under these conditions, a special construction was adapted, for both motors and control apparatus. These motors were only constructed in ½ h.p. and 5 h.p. sizes, but the exhaustive tests which they passed with entire success indicate that the construction



Thermal overload relay

of industrial type motors can be modified so as to render them suitable for efficient operation under gaseous atmospheric conditions."

Enclosed Motor Starters

"For several years past it has become evident that the trend of safety regulations was toward the enclosure of all types of motor starters and speed controllers. During the year, work along these lines was practically completed, and the remaining open type starters and speed controllers were provided with either self-contained enclosing cases with external handle or were redesigned to accommodate enclosing cases when required.

"A new thermal overload relay was designed to follow the heating and cooling curve of the average induction motor, and is particularly adapted to service where it

New pressure governor for use with automatic starters

is important that the motor be permitted to carry heavy short time overloads intermittently without being tripped out by the overload device. It will permit the motor to do any kind of work below a safe operating temperature.

"Two forms of resistor type magnetic starters for a.c. motors were produced; one for squirrel cage induction motors, and one for slip ring motors. Mechanically these starters are very much alike, their difference being chiefly in the connections. They both employ a new type of time element relay for the accelerating period that can be adjusted to about six seconds, which is ample time for the purpose. It consists essentially of an armature that is drawn across the face of an a.c. magnet by a spring which is distended when the line contractor closes. The magnetism resulting from the alternating current intermittently attracts and releases the armature as it slides by the pole face, thus giving the desired time adjustment.

"For the automatic control of motor-driven pumps, air compressors, etc., there was provided a new pressure governor for use in connection with automatic starters. This governor is of the Bourdon tube type, and can be used on any liquid or gas system that will not corrode the Bourdon tube. The equipment includes an "impulse" magnetically operated relay of a quick throw-over type that breaks its own operating circuit as soon as it functions."

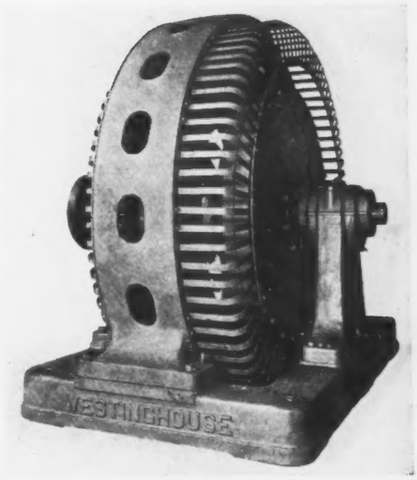
Diesel Electric Power for Dredges and Tow Boats

The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., announce the first Diesel electric tug boat ever built. This is a type of marine craft of much interest to many sand and gravel producers.

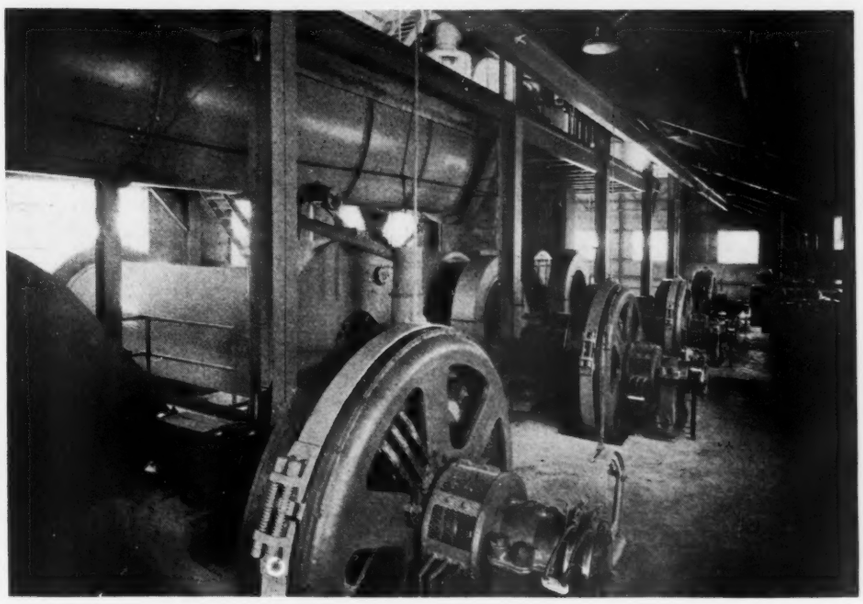
"Four Diesel electric hopper dredges built for the U. S. War Department, Corps of Engineers, were completed and put through their trials. All vessels very satisfactorily fulfilled the contract requirements, and their operation has been entirely successful.

"Each vessel is fitted with the largest Diesel electric plant ever installed on a ship. Electric power is used for propulsion, dredging and every other operation on board, including cooking and heating.

"The most important accomplishments of the year in the way of Diesel electric drive for ships was the completion of the first Diesel electric tug ever built. This boat was constructed for use in New York Harbor, particularly for tugging car floats. The hull is an exact copy of the standard reciprocating engine tug hull and is fitted with two Diesel generating sets and a double-unit propelling motor. The boat has now been in operation over six months and has proved extremely successful, surpassing all hopes of the engineers concerned with its development. Extensive tests have been made comparing this boat with the same size steam tug as well as with the direct-connected Diesel driven tug. The superiority of the



New type motor with low-current, high-starting torque



Typical installation of cement plant tube-mill drive with G.-E. latest type "super-synchronous" motor

The first Diesel-electric tug ever built

Diesel electric equipment has been demonstrated in a great many ways."

New Type Motor

The Westinghouse company has a new motor which has found particular favor in the portland cement and allied industries.

"This motor has been developed for use in drives where the advantageous characteristics of the synchronous motor are desirable and where high starting torque with low starting current is essential. The motor is a combination of a standard synchronous motor with a standard magnetic clutch arranged so as to form a compact unit. This permits the motor to start heavy loads with starting torque available up to the pull-out torque of the motor.

"The stationary part of the unit is identical with that of the standard synchronous motor. The rotor, however, is not keyed to the shaft, but is free to move on a bearing carried by the spider. The field member of the clutch is bolted to the spider, while its armature or driven half is mounted on a hub, keyed to the drive shaft.

"When starting, reduced voltage is applied to the machine bringing the rotor up to speed quickly, while the drive shaft remains stationary. When the rotor reaches synchronous speed, the field is excited and line voltage is applied to the stator. The clutch coil is then excited, drawing the two halves of the clutch together and the load is brought up to speed.

"Thus, the motor has the advantage of pull-out starting torque, with low starting current, combining these advantages with simple, rugged construction, high efficiency and the desirable power factor characteristics of standard synchronous motors. The equipment has the further advantage of being applicable to any type of control, i. e., manual, semi-automatic or full automatic."

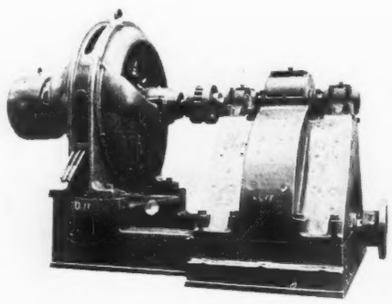
During the year the Westinghouse company put on the market a leak-proof sleeve bearing for industrial motors, which was described in Rock Products, May 31, 1924.

Fairbanks-Morse and Co., Chicago, Ill., have developed and perfected the cast-on end-ring construction for squirrel-cage motors and the production of ball-bearing motors. That the ball bearing motor has been a contribution appreciated by industry is shown by the fact that 75 per cent of the motors now produced by this company are equipped with ball bearings.

Oil Engines

Important progress has been made in the improvement of crude-oil and Diesel engines as prime movers in the rock products industries during 1924. We have already, under "Excavating and Material Handling" referred to the increasing popularity of this kind of power on shovels, cranes, etc.

Fairbanks-Morse and Co. announce another important development, in the vertical Diesel engine for marine and stationary service in ratings from 36 to 300 h.p. This engine is similar in design to the line of Type "Y" and "CO" engines which were formerly built, except that many refinements have been made and the engines start without the aid of auxiliary ignition devices.



Type K reduction gear

Although Fairbanks-Morse and Co. has installed over 700,000 h.p. in oil engines during the past twelve years, the potential market has barely been scratched according to J. D. Harper, general manager of oil engine sales.

Speed Reducers

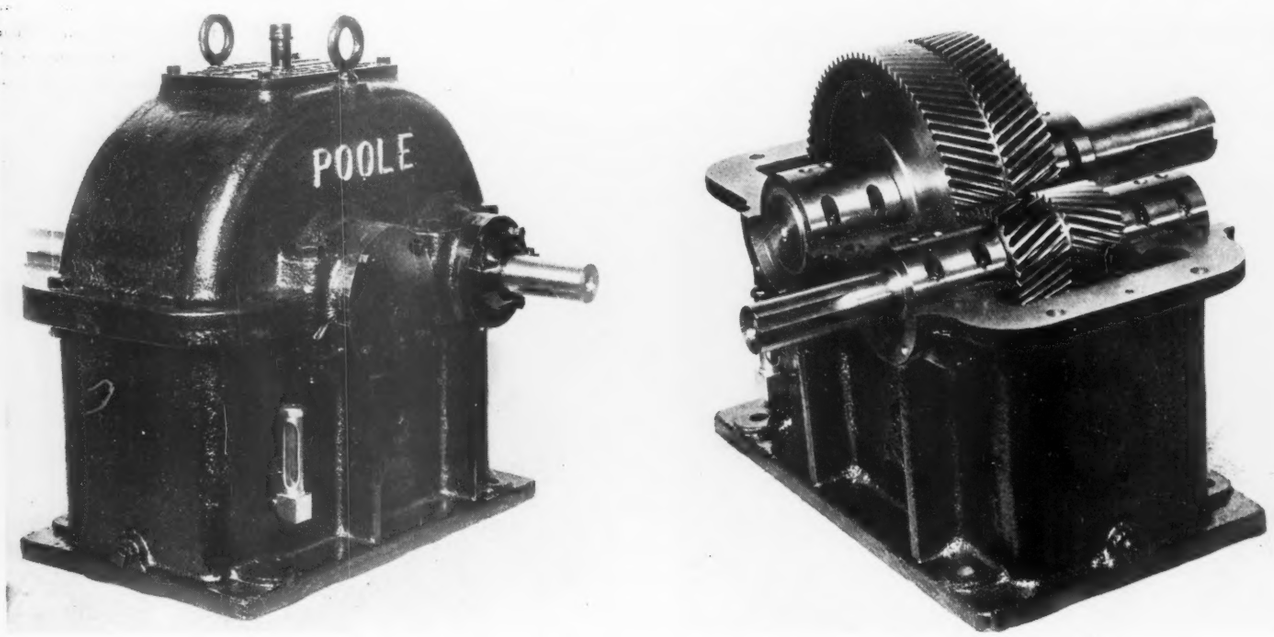
During the year the "New Machinery and Equipment" pages of Rock Products have reflected the activity in geared power transmission devices and speed reducers. The Palmer-Bee Co., Detroit, speeder reducers were described in the issue of July 26. The Hill Clutch Machine and Foundry Co., Cleveland, Ohio spur-gear speed transformers were described in the August 23 issue, and the Foote Bros. Gear and Machinery Co. spur-gear speed reducers in the November 29 issue.

F. A. Emmons, of the Foote Bros. Gear and Machinery Co., states:

"Spur gear and worm gear speed reducers are being widely used in nearly every industry and are being extensively specified by designing and consulting engineers for new equipment. They are particularly well adapted for operating screw, belt and bucket conveyors, stokers, feeders, hoists, elevators, rotary kilns in cement plants, car pullers, agitators slurry tanks, water screens, crushers and grinders.

"In cement mills, crushing plants and mines, the dust, dirt and grit which works havoc with ordinary open gearing, belts, pulleys, chains, etc., has no effect on the enclosed speed reducers."

During the year the Poole Engineering and Machine Co., Baltimore, Md., has developed and put on the market two new types of



Type H reduction gear with herringbone pinion and gear shown with and without casing

speed reduction gears, illustrated herewith. They are known as Type H and Type K, which are described as follows:

"The Type H reduction gear consists of a double helical or herringbone gear made of special analysis open hearth steel forging and a herringbone pinion cut integral with high speed shaft made of chrome vanadium steel. Both gear members are heat treated to proper hardness to minimize wear. Gear members are accurately ground and carefully tested for static balance before being assembled in gear casing.

"Gears and pinions are totally enclosed in a cast-iron, horizontally-split casing with bearing bosses integral with the top and bottom halves of casing. Casing joints are ground perfectly true to insure their being oil tight.

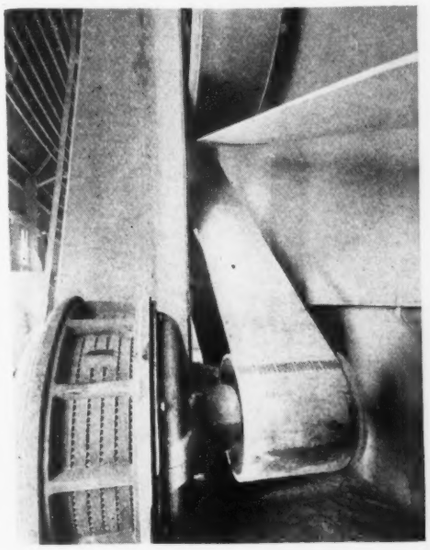
"The bearings are removable consisting of cast iron shells lined with genuine babbitted metal and are supported in bosses integral with top and bottom halves of casing insuring accurate and permanent alignment.

"For low speed drives thorough lubrication is obtained by an improved splash and gravity system in which the gear dips in the oil sufficiently to carry oil to a reservoir in the upper casing from which it feeds to all bearings and directly between the gear teeth at the line of contact.

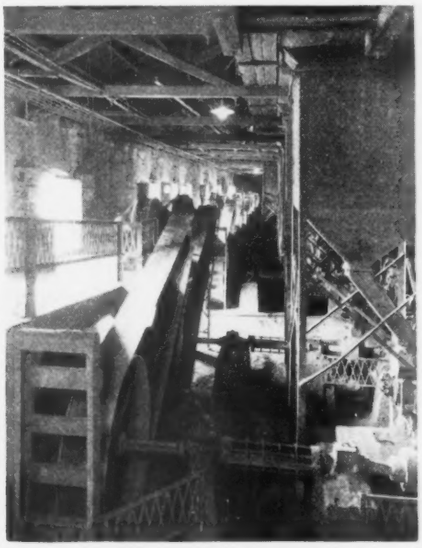
"For turbine and other high speed drives, an oil pump and cooler is provided, thus insuring cool oil under pressure to the bearings and gear teeth.

"The Type K reduction gear consists of double helical or herringbone forged steel pinion integral with shaft and a cast steel double helical spur gear. Both gear and pinion have cut stub teeth. The gear and pinion shafts are mounted in substantial babbitted bearings of the ring oiling type and the gear and pinion are lubricated by the splash system; the gear and pinion running in an oil tight oil filled case.

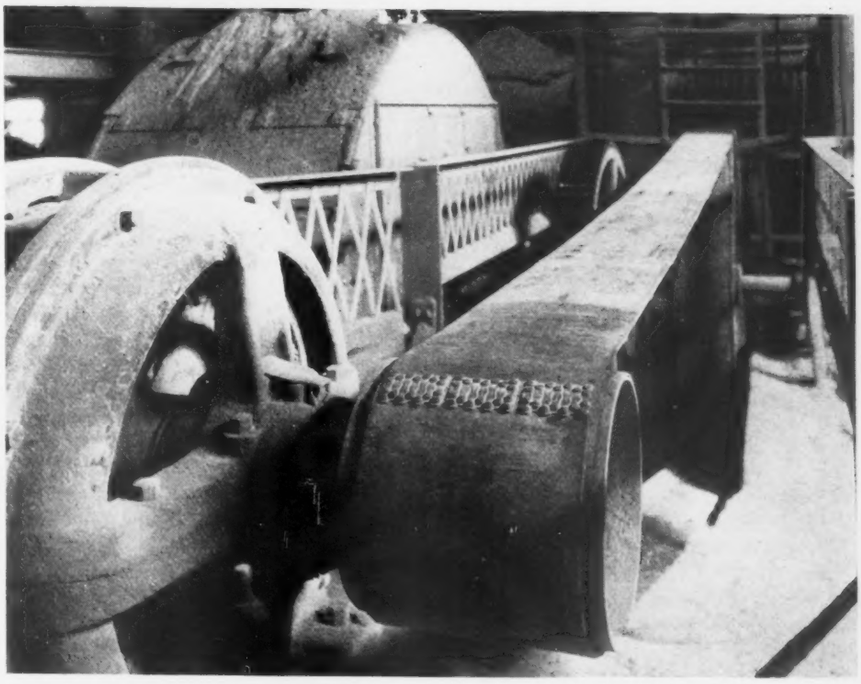
"The high speed shaft or driving pinion in the Type K gear is located in the top of the casing and the driven shaft is directly under the pinion shaft and just below or near the floor line which makes it especially desirable for certain types of machines used in industries where the line shaft is close to the floor."



Raw-grind mill drive



Driving line of 11 tube mills



Krupp mill drive by belt from motor

Improvement in Belt Drives

In spite of the progress made in speed reducers a great many belt drives are used in the rock products industries, and doubtless will continue to be used for a long time to come. The service of these is in no small degree dependent upon the belt fasteners. The Crescent Belt Fastener Co., New York City supply the accompanying views of some belt drives equipped with their fasteners during the past year. One view shows: 11 tube mill drives in a row; belts 20 in. wide, driver pulley 24 in., driven pulley 84 in. There are 16 of these drives in the building all joined with "Crescent" fasteners. There are three 175-h.p. motors, the others are 150-h.p., 600 r.p.m.

Another shows Smidth raw-grinding tube mills; belts, 22 in. wide driver pulley 24 in., driven pulley, 96 in. These are 175-hp. motors, 600 r.p.m. They generally run overloaded to 220 hp. There are 19 of these drives in a row.

A third shows a No. 8 Krupp mill drive; belt, 12 in. wide, driver pulley, 14 in. driven pulley, 76 in. Motor 75 h.p. 720 r.p.m. There are 14 of these mills.

Even Specialist in Coal

Another notable example of the desire of industries catering to producers of rock products to give them special and expert service is the advent of coal producers, like the Bertha-Consumers Co., Pittsburgh, Penn., who have studied and are prepared to meet the needs of manufacturers of cement, lime and gypsum, and the requirements of producers who have to make their own steam power. Another coal producer, the Graham Coal Co., Philadelphia, has recently become an associate member of the National Crushed Stone Association.

Road Development in Australia

A BILL just introduced in the Federal House of Representatives provides £500,000 for main roads development in 1924 and 1925. This makes £1,000,000 voted for the last two years.

Cement Products Machinery

AS is well told in Mr. Curtis' article in another part of this issue, the cement products industry has made a wonderful advance in 1924 and naturally the manufacture of cement products machinery has advanced with it. Something like 250 new factories for making cement products have been built this year and there are now 366 precast products which are recognized as regular articles of commerce. This advance has called for a great deal of new machinery.

A few of the more important of these plants were described in Rock Products during the year. The plant of the Pennsylvania Brick and Tile Co. of Philadelphia, which is one of the largest, was described in the issue of May 5. This has a capacity for 150,000 brick per day and uses sand from the Delaware river section as aggregate. There are four Kent Machine Co. mixers employed and 16 Anchor brick machines. Steam curing is carried on in eight chambers each of which holds 25,000 brick.

An important feature of this, as of all other large production plants, is the amount of material handling machinery that is used. A 1½-yd. Williams clamshell, with a 60-hp. double drum Flory hoist and General Electric motor, are used to lift the sand to the plant hopper. Link Belt conveyors, one 300 ft. and one 310 ft., take it to the mixers. A Jeffrey sand drag draws in sand to a hopper in closed circuit with the belt hopper. Jeffrey feeders are used with the mixers. In fact labor saving machinery seems to be used wherever it can be used to advantage.

The new cement products plant of the Dixie Sand and Gravel Co., a subsidiary of the Dixie Portland Cement Co., was described in the issue of Nov. 15. This plant makes brick and roofing tile as well as the standard sizes of concrete block and special shapes such as lamp posts, gate posts and lawn furniture. A power tamper made by the McIntyre Machine Co., of Detroit is used. This plant also employs material handling machinery to bring cement and aggregate to the mixers.

The brick plant of the Atlanta Sand and Supply Co. is described in the issue of November 29. This is an interesting plant as it uses its excess production of silica sand as an aggregate and also uses it to mix with the mineral color employed to make an exceedingly hard and waterproof face on the brick. The Shope process and Shope machines are used and the concrete is mixed in Blystone mixers. The material handling system includes an elevator by which the concrete materials are elevated to the upper floor of the plant where the mixers are placed and a monorail system by which the mixed concrete is conveyed to the various machines.

The H. E. Bester plant at Hagerstown, Md., was described December 15. This plant makes brick, block and special shapes and is interesting from the fact that the power tamping machine, which works very successfully, was designed and built by the proprietor of the plant.

The hydraulic pressure block machine made by Kenny Bros., Columbus, Ohio, was described in the October 4 issue. This machine, which was placed on the market in 1924, forms the blocks under 200,000 pressure in a hydraulic press and applies the pressure at the top and bottom of the block at the same time so that the block is not only dense but homogeneous. The resulting block has very sharp and clean faces and edges.

One of the most important developments in the cement products field has been the manufacture of roofing tile. These are now made in great quantities in several of the larger cities and are meeting an increased demand. An excellent article on the manufacture of concrete roofing tile was published in Rock Products October 23, 1923.

Among the larger companies making roofing tile is the Hawthorne Roofing Tile Co., Cicero, Ill. The machines used by this company have been put on the market by the Concrete Tile Machinery Co., composed of executives of the Hawthorne Co. of Cicero. These machines are adapted to making all the shapes required in roofing tile including the standard tile and the various starters and finishers for hip, ridge and gable. They are made for both Spanish and French tile.

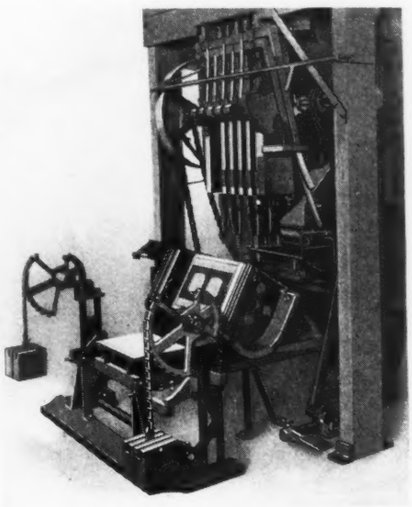
The tile making machine is made of heavy cast iron parts so as to avoid vibration and all gears are enclosed and run in oil. Unbreakable steel pallets are used for the forming of the tile and are fed into the machine at the rate of 14 per minute. As they are carried forward they are lightly sprayed with oil and then they pass under a concrete hopper which is kept filled to the correct height by a specially designed feeder.

After the pallet is filled it passes out from under the hopper to the tamping device which strikes it 60 blows of uniform pressure. Then it goes under the color mixer which consists of a double set of full floating trowels between which a top coating of cement, color pigment, fine sand and water is applied. The first trowel smooths the concrete and the second the color mixture. From the color mixer the tile is automatically transferred to a belt conveyor which carries it to the curing space where in 24 hr. it is ready to be removed from the pallet and stacked for final curing.

The Hawthorne company in its own roofing tile plant also employs a considerable quantity of material handling machinery. Freight cars dump the sand from which the tile is made into a track hopper from which it is carried by conveyors to a large silo. From the silo it is elevated to the supply bin over the mixer. Portland cement is received in bulk and elevated to its supply bin over the mixer.

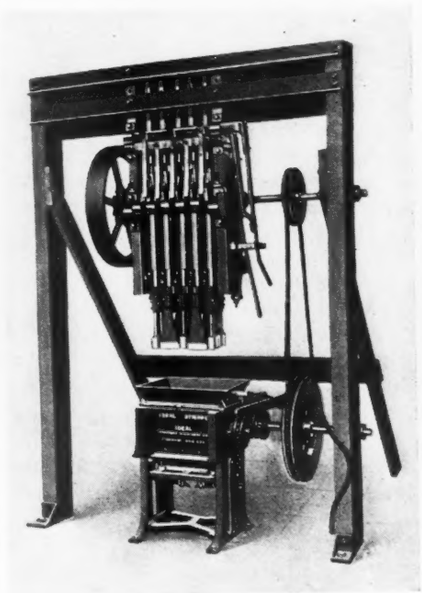
This company expects to double its production in the next three months.

The Ideal Concrete Machinery Co., Cincinnati, Ohio, which is one of the pioneers in making cement products machinery, in 1924 placed on the market four machines which may be used for making all the common



Power roll over stripper

forms of cement products. The first of these is the power roll-over stripper, which in the new model the makers say possesses the same features as the previous model, that is, feeding and tamping at the same

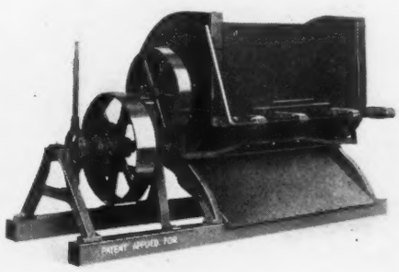


Vertical stripper

time, delivery of the block onto a wooden pallet, use of the same sized pallet for all sizes of block and tile and high speed due to the fact that pallets are changed while the next block is being made. The speed of

the machine has been further increased by the adaptation of power to the feeding, scraping and roll over motion. The machine is arranged so that in case of a jam due to a rock or any foreign matter getting into the mold box, the feeding or scraping mechanism will slip without any damage to the machine.

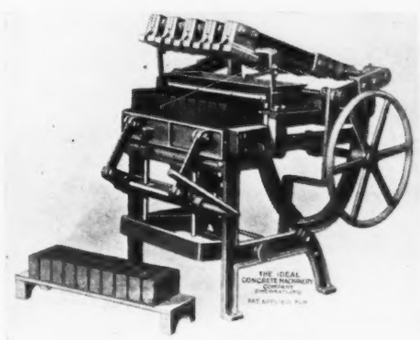
The vertical stripper is for the production of concrete block or tile in plants of such size that the expense and output of the



A 14-ft. concrete mixer

power roll-over stripper would not be warranted. It has the ability to make varying sizes of block and tile on the same machine by the quick interchange of simple attachments. In connection with the patented stripping device, there is incorporated a power stripping mechanism in this machine which eliminates the laborious stripping of a tamped block by means of a long hand lever. It is of low and convenient off-bearing height, the top being no higher from the ground than the standard face-down machine.

The 14-ft. concrete mixer has been added to the Ideal line during the past year because of the success of the 9-ft. mixer. The dumping mechanism is the same as on the 9-ft. mixer and the machine is built of suit-



Face-up brick machine

able weight to take care of the extra load. The center shaft is 3-in. cold rolled steel. The paddle arms are steel castings and the paddles are manganese steel. The machine can also be equipped with manganese steel wearing plates, 5/8 in. thick. The machine is driven by double cast steel gears and cut steel pinions and the shaft is reinforced by an outboard bearing outside the drum. The makers say this machine is designed to be trouble-proof and give a constant and large supply of concrete for the larger plants.

The Face-Up brick machine of the Ideal company is designed to manufacture either common concrete brick or rough face-cut brick. The latter are made by trowelling the face onto the brick while they are still in the machine, and treating to simulate any desired surface. The front plate slides down out of the way with a quarter turn of the lever, which slides in heavy babitted bearings. During the filling and tamping operation the mold box is automatically locked tight, assuring true and square brick. Machines are equipped for either foot or power tamping and use wooden pallets.

The Anchor Concrete Machinery Co., Adrian, Mich., and Columbus, Ohio, has put out its "Junior" high-test tile machine with the under the floor type of tamper and power feeder and elevator. This makes two 5x8x12-in. tile at one operation with either plain or corrugated face and parts can be furnished for 5x4x12-in., 5x6x8-in., 5x8x10-in. or jamb tile.

Special Steels and Alloys

THE rock products industries, with installations of massive excavating, crushing, grinding and conveying machinery, working under dusty, dirty and exposed conditions are certainly second to none in their requirements for toughness, hardness, strength and durability in machine parts. Consequently they offer a large and ever expanding field for special steels and alloys. This is clearly brought out in a splendid analysis of the repair problem by John C. Taylor, of the Taylor-Wharton Iron and Steel Co., High Bridge, N. J., who states:

"Troubles in the rock products industry are not confined to any particular part of plant or equipment, yet we have found that no part of this industry gives the operators more concern than the machines in operation. The investment in this equipment, and the dependence of the output upon it, make it imperative that the operation be as free from interruptions as possible, and aside from the exceptional accident, which happens rarely, this boils down to the important question of repairs.

"Deliveries, prices, etc., are factors and important ones, but the elimination of much trouble and expense is contingent upon the question of uniformity of the steel used in the manufacture of wearing parts. If a wearing part placed in a machine wears six months, the operator would like to be confident that the next replacement will also wear approximately six months. He can then forget this part of the machine knowing that he will receive material of uniform quality, and that a renewal is approximately six months away. Compare the trouble of this man with the one who finds the second repair part wears thirteen months instead of six, and the third only two months. Such a condition means that this machine must be inspected constantly and the time lost is considerable. Long life in repairs is most desirable, but ten castings used in the same machine for the same purpose, that last seven months each, are more satisfactory and economical than ten that show an average life of seven months, but individually give a life of from one to twenty months. Long life must be consistent with uniformity.

"Uniform quality again enables the purchaser to buy repairs far enough in advance to eliminate much trouble now caused by delayed deliveries. The exceptional rush order will, no doubt, always exist, but the number can be very much reduced if the material has the same general average quality.

"In the manufacture of manganese-steel castings, a range from 10% to 14% in the manganese content is allowed by most standard specifications. A similar wide range is allowed in the content as concerns other elements. During the past year, we have narrowed the limits to about one-half of this standard range. We have also narrowed the limits which we allow in heat treatment variation, and are producing a product which is as uniform as can be made with modern equipment and under modern conditions.

"Our experience in furnishing repair parts dates back many years. Files of engineering data and records, based on experience, are complete and are continually being increased.

"We are convinced that 'Tisco' manganese-steel castings today give even more service per dollar than they have done in the past. Most machine builders now furnish these parts as repairs for their machines."

Manganese-Steel Screen Cloth

J. I. Capps, of the American Manganese Steel Co., Chicago, Ill., states that the year 1924 has seen manganese steel extended into the rock products field as never before. An example of this is the use of manganese steel in the construction of woven-wire screen cloth, illustrated herewith. Screening surfaces of all types are now made of this alloy.

Some comparative figures on the wear of screen cloth are given by Mr. Capps as follows:

"Some test figures have been secured from some of the large copper companies which are using our screens of this type:

"Woven wire grizzly screens in front of ore bin feed gates:

"Size of holes, 3 in.

"Size of each section, 5 ft. 2 in. x 6 ft. 9 in.

"Sections required for grizzly, 4.

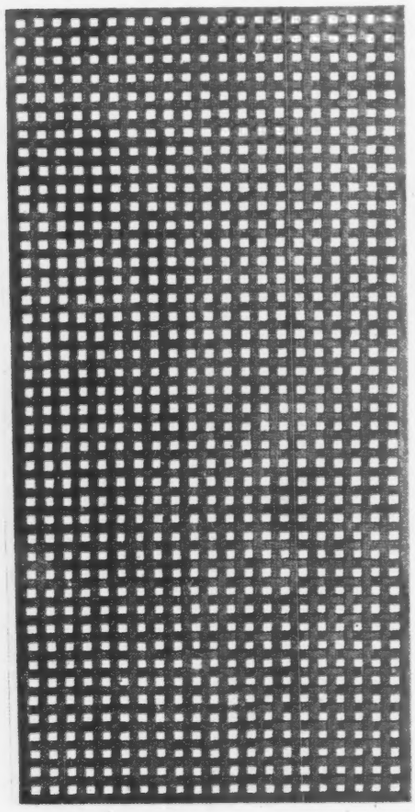
"Life of each grizzly, 7 months.

"Of a total of 35 pieces on hand the life was 28 months.

"Original cost per piece, $80.

"Complete cost one grizzly, $320.

"Life of one grizzly, 415 shifts, 207 days, 7 months.



Woven manganese steel screen

"Cost material only per 7 months per grizzly, $320.

"Cost material only per 48 months, $2,240.

"Manganese screens (cast woven type):

"In stock, none.

"Installed on Christmas, 1917.

"Life to date, 4 years or 48 months.

"Cost of each piece, $225.

"Number of pieces per grizzly, 8.

"Cost per grizzly, $1,800.

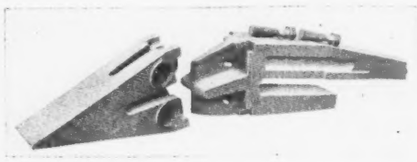
"Life of grizzly to date, 4 operating years or 48 months.

"Balance of cost of material only in favor of manganese grizzlies as compared to the woven wire grizzlies, $440.

"Besides the saving of $440 for material only, as indicated above, there is a further very important saving through the use of the manganese grizzlies on account of the fact that less than half of the labor is required for changing and turning screens."

A New Dipper Tooth

Another new product of the American Manganese Steel Co. is the Mullaly reversible dipper tooth, also illustrated herewith. It is described as follows: "Although a recent design, it has been thoroughly tested under the most severe working conditions and has been found to be highly satisfactory. Steam shovel operators pronounce it an excellent design. Some of the advantages of this tooth are: (1) Two bolts are provided for holding on points. No direct strain on either bolt—so that there is no danger of point becoming loose. (2) Bolts are put in on an angle and tapered so that the point can be drawn up perfectly tight on the base.



Mullaly reversible dipper tooth

(3) A complete cross flange is provided on the base portion so that all strains, either horizontal or vertical, will be transmitted to at least three of the flanges at one time. (4) Four individual tapered flanges on base, so that points will automatically tighten when digging; also tighten when put under side strains. (5) Lugs are provided at intersection of base and point, making a positive lock.

A New Manufacturer Enters Field

Probably nothing better illustrates the increasing use of manganese-steel parts in the rock products and allied industries than the remarkable success of a comparatively new comer in the field—the Hatfield-Penfield Steel Co., Bucyrus, Ohio. Arthur W. Litcroft, manager of the steel department, writes:

"The progress of The Hadfield-Penfield Steel Co.'s manganese-steel and steel departments during the year 1924 is very satisfactory. It was not hoped by those in charge of these departments that the growth of over 200% annually achieved during the years 1922 and 1923 could be maintained. It was such an unusual record for any new company that, regardless of how well-known the product, such a rapid expansion could not be kept up, nor would it be desired.

"'Era' manganese-steel engineers have found a surprising number of new applications for the use of manganese steel in industries and places where this metal was not formerly used, the various applications ranging from the handling of talc rock to the conveying of food productions.

"In castings for conveyor parts such as elevator buckets, rolls, and screw conveyors, a number of improvements have been made; in the sand and gravel industry, a new design of chute, and improvements in centrifugal pump parts. Renewable sprocket teeth and sprocket rims have been developed. How essential some of these new applications are to economical production is illustrated by the change made in one of the largest sand and gravel producing plants where a new design of casting gave a service of three times the life of the previous casting used and increased the operating efficiency more than 50%.

"In the rock-crushing industry, a new design of sectional crusher head has met with wide approval.

"Special perforated screen plates, both cylindrical and flat, have found a wider use, and have demonstrated the saving that can be effected in the use of castings or plates which do not require frequent replacement.

"A standard chute design in one piece, and easily installed, has been developed and proven very satisfactory. Renewable tooth sprocket rims for large conveyors have proved an economical and new installation.

"Manganese steel sheave wheels for dragline equipment, wherever wire ropes are used, have proved economical, both in the life of the sheave and by the fact that the wire rope running over a manganese-steel sheave wheel will have a minimum life 25% greater than running over any other type of sheave, effecting a saving both in the rope and wheel itself, and in the reduction of the number of times replacements are necessary."

Steam Shovel Chains

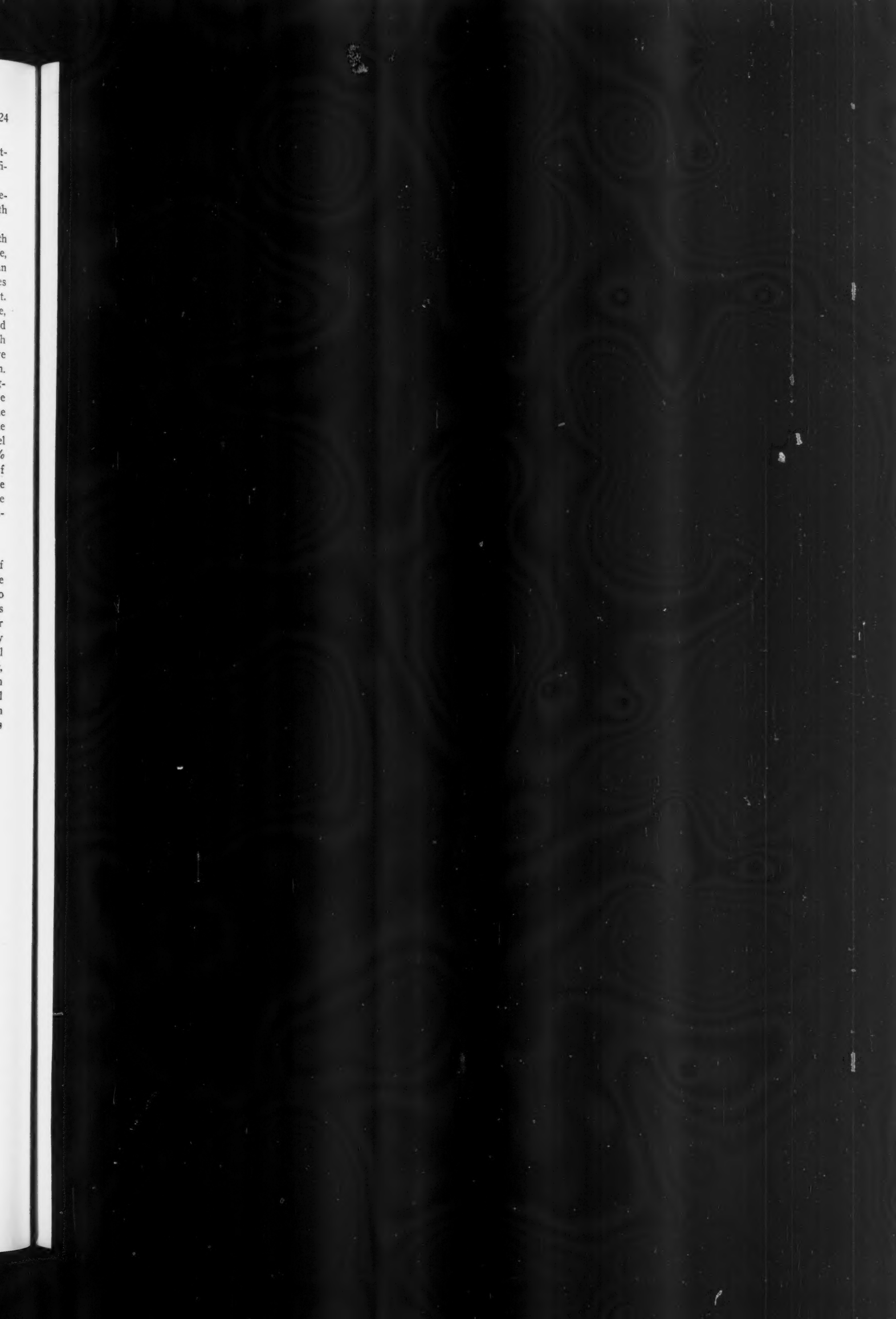
An improvement in the manufacture of steam-shovel chains is announced by the S. G. Taylor Chain Co., Chicago, Ill., to further eliminate the possibility of links splitting, which was common when regular plate piled iron was used. This company have changed their specifications at the mill to have an iron furnished of square piling, with a special plate on the piling which when rolled into round bars and etched gives the effect of a checkerboard piling with a special collar around the outer edge. This

Effect of "square piling"

is visible in the illustration shown herewith.

This method of piling is not a new one at the mill, as it has been used by the U. S. Navy Department. They have made severe tests which have proven conclusively that it does actually reduce to a minimum the splitting of links.

There are various kinds of checkerboard iron used in the manufacture of chain. An iron free from any foreign substances such as steel or scrap, is desirable, as it is a well known fact that iron and steel require different heats for welding and an iron which contains these foreign substances cannot be welded as thoroughly and securely as a purely fibrous triple rerolled refined muck bar iron.



T.C. 12-14-25 A.A.H.

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Hazard Mfg. Co., Wilkes-Barre, Penn.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
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Chicago Bridge and Iron Works, Chicago, Ill.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Air Compressor Works, Brooklyn, N. Y.
American Steam Pump Co., Battle Creek, Mich.
Beckwith Machinery Co., Pittsburgh, Penn.
Bethlehem Steel Co., Bethlehem, Pa.
Bessemer Gas Engine Co., Grove City, Pa.
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Bury Compressor Co., Erie, Penn.
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The Denver Rock Drill Mfg. Co., Denver, Colo.—portable—see page 64
Fairbanks, Morse & Co., Chicago, Ill.
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Manning, Maxwell & Moore, Inc., New York, N. Y.
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Norwalk Iron Works, South Norwalk, Conn.
Novo Engine Co., Lansing, Mich.—portable
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Schramm, Inc., West Chester, Penn.
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Sullivan Machinery Co., Chicago, Ill.—see page 216
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Wayne Tank & Pump Co., Ft. Wayne, Ind.
Worthington Pump & Machinery Corp., New York, N. Y.

AIR SEALS (Kiln)

Babcock-Wilcox, New York, N. Y.
Bonnot Co., Canton, O.
Edge Moor Iron Co., Edge Moor, Del.—for junction of kilns and kiln housings
Heine Boiler Co., St. Louis, Mo.
J. S. Scofield's Sons Co., Macon, Ga.—see pages 234-235
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

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R. M. Gay Co., Inc., New York, N. Y.—see page 60
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Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 42-43
Sturtevant Mill Co., Boston, Mass.—see page 257
W. W. Sly Mfg. Co., Cleveland, O.—see page 193
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see pages 34-35

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Mackintosh-Hemphill Co. Pittsburgh, Penn.—see page 247

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American Appraisal Co. Milwaukee Wis.

ASBESTOS PRODUCTS

Johns-Manville, Inc., New York, N. Y.

ASH and REFUGE HANDLING MACHINERY

Austin Mach. Corp. Toledo, O.
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R. H. Beaumont Co., Philadelphia, Pa.
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Chain Belt Co., Milwaukee, Wis.
Conveyors Corp. of America, Chicago, Ill.
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Gifford-Wood Co., Hudson, N. Y.
Gruendler Pat., Cr. & Pulv. Co., St. Louis, Mo.—see page 188
The Geo. Haiss Mfg. Co., New York, N. Y.
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The Hamilton Mfg. Co., Columbus, O.
The Hayward Co., New York, N. Y.
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Pawling and Harnischfeger Co., Milwaukee, Wis.
Portable Machinery Co. Passaic, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

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American Car and Foundry Co., Chicago, Ill.
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Bethlehem Steel Co., Bethlehem, Penn.
Easton Car & Construction Co., Easton, Penn.—see page 204
Gustafson Manufacturing Co., Chattanooga, Tenn.
Helm Brick Machine Co., Cadillac, Mich.
Kenova Mine Car Co., Kenova, W. Va.
Koppel Industrial Car & Equip. Co., Koppel, Penn.
Lobdell Car Wheel Co., Wilmington, Del.
Pennsylvania Casting and Machine Co., Pittsburgh, Penn.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.

BABBITT METAL

Ajax Metal Co., Philadelphia, Penn.
The Paul R. Brown Co., New York, N. Y.
A. W. Cadman Mfg. Co., Pittsburgh, Penn.
Colonial Supply Co., Pittsburgh, Penn.
General Electric Co., Schenectady, N. Y.
Hoyt Metal Co., St. Louis, Mo.
Magnolia Metal Co., New York, N. Y.
Manning, Maxwell & Moore, Inc., New York, N. Y.
More & Jones Brass & Metal Co., St. Louis, Mo.
Paul S. Reeves & Son, Philadelphia, Pa.
Joseph T. Ryerson, Chicago, Ill.
United American Metals Corp., Brooklyn, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.

BACK FILLERS—Ditching Machines

The American Cement Machine Co., Inc., Keokuk, Ia.
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
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Pawling & Harnischfeger Co., Milwaukee, Wis.
Chas. T. Topping Mch. Co., Pittsburgh, Penn.

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The Adams Bag Co., Cleveland, O.
Bates Valve Bag Co., Chicago, Ill.—cloth and paper
Bemis Bag Co., St. Louis, Mo.—jute, paper and waterproofed
H. Goldman & Sons Co., Rochester, N. Y.
Hammond Bag & Paper Co., Wellsburg, W. Va.—waterproof paper
The Jaite Co., Jaite, O.—paper, all kinds—see inside back cover
Kennedy Car Liner & Bag Co., Shelbyville, Ind.—special paper—see page 236
Miller, Tompkins & Co., New York, N. Y.—open mouth, paper
National Bag Co., Naperville, Ill.—mailing
The Penn Bag Co., Philadelphia, Penn.—paper
Philadelphia Bag Co., Philadelphia, Penn.—burlap and cotton, all sizes
Raymond Bag Co., Middletown, O.—rope, paper
Taggart Brothers Co., Watertown, N. Y.—rope, paper
The Valve Bag Co. of America, Toledo, O.—see pages 8-9
Western Valve Bag Co., Chicago, Ill.—valve

BAG COUNTING and BUNDLING MACHINERY

The Faeberhill Mfg. Co., Cleveland, O.
The Republic Steel Package Co., Cleveland, O.
Western Valve Bag Co., Chicago, Ill.

BAG MACHINERY

Bates Valve Bag Co., Chicago, Ill.
Hammond Bag & Paper Co., Wellsburg, W. Va.
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Union Special Mach. Co., Chicago, Ill.
The Valve Bag Co. of America, Toledo, O.—see pages 8-9
Western Engineering & Manufacturing Co., Chicago, Ill.
Western Valve Bag Co., Chicago, Ill.

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Bates Valve Bag Co., Chicago, Ill.

BALANCES and WEIGHTS (Chemical)

Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
E. H. Sargent & Co., Chicago, Ill.

BALLS—Tube Mill, Steel, Iron, Etc.

Abbe Engineering Co., New York, N. Y.
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J. R. Alsing Engineering Co., New York, N. Y.
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Ann Arbor Foundry Co., Ann Arbor, Mich.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hardinge Co., New York, N. Y.—see page 3
Los Angeles Foundry Co., Los Angeles, Calif.
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21

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Philadelphia Steel & Iron Co., Philadelphia, Penn.
F. L. Smidth and Co., New York, N. Y.—see pages 210-211
Standard Steel and Bearings, Inc., Philadelphia, Penn.
Steacy-Schmidt Mfg. Co., New York, N. Y.—cast iron, chilled steel
Tioga Steel & Iron Co., Philadelphia, Penn.—steel

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Buffalo Forge Co., Buffalo, N. Y.
Koehring Co., Milwaukee, Wis.—see pages 38-39

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The Bucyrus Co., South Milwaukee, Wis.—steel—see page 23
Midland Barge Co., Midland, Penn.—steel

BARRELS

The Cleveland Steel Barrel Co., Cleveland, O.
Draper Mfg. Co., Cleveland, O.
International Cooperage Co., Niagara Falls, N. Y.
Knapp Metal Barrel & Package Co., San Francisco, Calif.
The Ohio Corrugating Co., Warren, O.—steel
The Sandusky Cooperage & Lbr. Co., St. Louis, Mo.
D. H. Stoll Co., Buffalo, N. Y.—steel
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

BARREL MAKING MACHINERY

The D. H. Stoll Co., Buffalo, N. Y.
E. & B. Holmes Co., Buffalo, N. Y.

BARS and RODS

Bethlehem Steel Co., Bethlehem, Penn.
Biehl Iron Works, Inc., Reading, Penn.
Central Frog & Switch Co., Cincinnati, O.—see page 27
L. B. Foster Co., Pittsburgh, Penn.—see page 252
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Philadelphia Steel & Iron Co., Philadelphia, Penn.
Jos. T. Ryerson & Son, Chicago, Ill.
Wood Drill Works, Paterson, N. J.

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Gurney Ball Bearing Co., Jamestown, N. Y.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 245
Hyatt Roller Bearing Co., New York, N. Y.—all types
Kelmet Metals Co., Inc., Cleveland, O.
Kennedy Van-Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Koppel Industrial Car & Equip. Co., Koppel, Penn.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
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The Medart Co., St. Louis, Mo.
W. F. Mosser & Son, Allentown, Penn.
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A. Plamondon Mfg. Co., Chicago, Ill.
The Reeves Bros. Co., Alliance, O.—see page 228
Standard Steel and Bearings, Inc., Philadelphia, Penn.—ball
The Transmission Ball Bearing Co., Buffalo, N. Y.
Timken Roller Bearing Co., Canton, O.—roller, tapered, thrust—see page 41
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Weller Mfg. Co., Chicago, Ill.—see page 240
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.
T. B. Wood's Sons Co., Chambersburg, Penn.

BELT DRESSING

Alexander Bros., Philadelphia, Penn.
Crescent Belt Fastener Co., New York, N. Y.—see pages 237-248
The Druid Oak Belting Co., Inc., Baltimore, Md.
Gandy Belting Co., Baltimore, Md.—see page 61
Graton & Knight Mfg. Co., Worcester, Mass.
Main Belting Co., Philadelphia, Penn.
Mount Vernon Belting Co., Baltimore, Md.
J. E. Rhoads & Son, Philadelphia, Penn.
Texas Co., New York, N. Y.
Tidewater Oil Co., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.—bar and liquid
United States Rubber Co., New York, N. Y.

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Bristol Co., Waterbury, Conn.—see page 248
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Detroit Belt Lacer Co., Detroit, Mich.
Flexible Steel Lacing Co., Chicago, Ill.—see page 253
Graton & Knight Mfg. Co., Worcester, Mass.—cement
Main Belting Co., Philadelphia, Penn.
Victor Balata & Textile Belting Co., New York, N. Y.

BELT LACING

Alexander Bros., Philadelphia, Penn.
The Bristol Co., Waterbury, Conn.—see page 248
Cleveland Belting & Mach. Co., Cleveland, O.
Crescent Belt Fastener Co., New York, N. Y.—see pages 237-248
Clipper Belt Lacer Co., Grand Rapids, Mich.
Detroit Belt Lacer Co., Detroit, Mich.
The Druid Belting Co., Inc., Baltimore, Md.
Flexible Steel Lacing Co., Chicago, Ill.—see page 253
The Graton & Knight Mfg. Co., Worcester, Mass.—rawhide
National Leather Belting Co., New York, N. Y.
J. E. Rhoads & Son, Philadelphia, Penn.

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Alexander Bros., Philadelphia, Penn.
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Burr Oak Belting Co., Cincinnati, O.
Chain Belt Co., Milwaukee, Wis.
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Cleveland Belting & Machine Co., Cleveland, O.—leather, canvas, rubber, cotton
Corns Conveyor Belt Co., Chicago, Ill.
R. & J. Dick Co., Inc., Passiac, N. J.—Balata
Dodge Mfg. Co., Mishawaka, Ind.
The Druid Oak Belting Co., Inc., Baltimore, Md.—leather
Empire Tire & Rubber Corp. of N. J., Trenton, N. J.—transmission, conveying
Evansville Leather & Belting Co., Evansville, Ind.
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J. E. Rhoads & Son, Philadelphia, Penn.—leather
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.—transmission, conveying
W. H. Salisbury & Co., Inc., Chicago, Ill.
Sandvik Steel, Inc., New York, N. Y.—steel conveying
Stanley Belting Co., Chicago, Ill.—cotton belt
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Upson-Walton Co., Cleveland, O.—canvas
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H. Miscampbell, Duluth, Minn.—see pages 30-31
Northern Blower Co., Cleveland, O.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246
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Universal Road Machinery Co., Kingston, N. Y.—see page 250
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Wiederholt Construction Co., New York, N. Y.
Wisconsin Bridge and Iron Works, N. Milwaukee, Wis.
The Youngstown Boiler & Tank Co., Youngstown, O.—steel, all kinds

BLASTING ACCESSORIES

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The Grasselli Powder Co., Cleveland, O.—see page 208
General Explosives Co., Chicago, Ill.
Hercules Powder Co., Wilmington, Del.—see page 16
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Penn.

BLASTING POWDER
(See Explosives)

BLOCKS

American Hoist & Derrick Co., St. Paul, Minn.—wire rope—see page 251
Beach Mfg. Co., Charlotte, Mich.—sheave
Jas. H. Channon Mfg. Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
The O. H. Davidson Equipment Co., Denver, Colo.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.—sheave
Hanson Clutch & Machy. Co., Tiffin, O.—pillow
The Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Hyatt Roller Bearing Co., New York, N. Y.—pillow, roller bearing
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 288
Macwhyte Co., Kenosha, Wis.
The Medart Co., St. Louis, Mo.—pillow
Mining Machine Co., Mountville, Penn.—steel sheave
Plamondon A., Mfg. Co., Chicago, Ill.—pillow
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

BLOCK MACHINERY—Concrete

Anchor Concrete Machinery Co., Adrian, Mich.—see page 232
The Besser Sales Co., Chicago, Ill.
Blystone Mfg. Co., Cambridge Springs, Penn.
Concrete Equipment Co., Holland, Mich.
Helm Brick Machinery Co., Cadillac, Mich.
Ideal Concrete Machinery Co., Cincinnati, O.—see page 255
Kent Machine Co., Kent, O.
Multiplex Concrete Machinery Co., Elmore, O.
Thos. W. Noble Co., Chicago, Ill.
Wert Mfg. Co., Chicago, Ill.
Zagelmeyer Cast Stone Block Machinery Co., Bay City, Mich.—see page 254

BLOWING AND SUCTION DEVICES

J. R. Alsing Engineering Co., New York, N. Y.
American Blower Co., Detroit, Mich.
American Gas Furnace Co., Elizabeth, N. J.
The Bayley Mfg. Co., Milwaukee, Wis.—see page 186
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Penn.
Clements Mfg. Co., Chicago, Ill.
Connersville Blower Co., Connersville, Ind.
DeLaval Steam Turbine Co., Trenton, N. J.—centrifugal blowers
The Dust Recovering & Conveying Co., Cleveland, O.
Electric Vacuum Cleaner Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
The Northern Blower Co., Cleveland, O.
B. F. Sturtevant Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

BLOW TORCHES, HEATERS, THAWING OUTFITS, SNOW MELTERS AND BRAZING OUTFITS

Aeroil Burner Co., Inc., Union Hill, N. J.
Alexander Milburn Co., Baltimore, Md.
American Blower Co., Detroit Mich.
Champion Blower & Forge Co., Lancaster, Penn.
Colonial Supply Co., Pittsburgh, Penn.
Cutler-Hammer Co., Milwaukee, Wis.
Hauck Mfg. Co., Brooklyn, N. Y.
Ingersoll-Rand Co., New York, N. Y.
The MacLeod Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Weldit Acetylene Co., Detroit, Mich.—see page 62

BODIES—Commercial Car

Acme Motor Truck Co., Cadillac, Mich.
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Columbia Steel Tank Co., Kansas City, Mo.
Easton Car & Construction Co., Easton, Penn.—see page 204
The Heil Co., Milwaukee, Wis.—dump
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
International Motor Co., New York, N. Y.—steel dumping
Lee Trailer & Body Co., Chicago, Ill.—dump for motor trucks
Littleford Bros., Cincinnati, O.—steel
Reeves Bros. Co., Alliance, O.—see page 228
Standard Steel Works, North Kansas City, Mo.—dump
U. S. Motor Truck Co., Cincinnati, O.
Wood Hydraulic Hoist & Body Co., Detroit, Mich.

BOILERS

Babcock & Wilcox, New York, N. Y.
Bethlehem Ship Building Corp., San Francisco, Cal.
The Biehl Iron Works, Inc., Reading, Penn.
The Brownell Co., Dayton, O.
Clyde Iron Works, Duluth, Minn.
Coatsville Boiler Works, Philadelphia, Penn.
Edge Moor Iron Co., Edge Moor, Del.—waste heat, water tube
Erie City Iron Works, Erie, Penn.
Freeman Mfg. Co., Racine, Wis.
Heine Boiler Co., St. Louis, Mo.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Hyde & Co., Pittsburgh, Penn.—water tube
George T. Ladd Co., Pittsburgh, Penn.
The Mine and Smelter Supply Co., New York, N. Y.—see pages 20-21
Murray Iron Works Co., Burlington, Ia.—all types
Orr & Sembower, Reading, Penn.—all types
Steacy-Schmidt Mfg. Co., New York, N. Y.
The Walsh & Weidner Boiler Co., Chattanooga, Tenn.
The Wickes Boiler Co., Saginaw, Mich.—waste heat
Youngstown Boiler & Tank Co., Youngstown, O.

BOILER COMPOUND

Dearborn Chemical Co., Chicago, Ill.
Johns-Manville, Inc., New York, N. Y.
Scientific Boiler Chemical Works, Chicago, Ill.

BOILER TUBES

Babcox & Wilcox Tube Co., Beaver Falls, Penn.
Bethlehem Steel Co., Bethlehem, Penn.
Hyde & Co., Pittsburgh, Penn.
Jos. T. Ryerson & Son, Chicago, Ill.

BOX CAR LOADERS

Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Manierre Eng. & Mach. Co., Milwaukee, Wis.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194

BRAKES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—magnetic
Electric Controller & Mfg. Co., Cleveland, O.—electric
General Electric Co., Schenectady, N. Y.
Safety First Supply Co., Pittsburgh, Penn.
Westinghouse Elec. and Mfg. Co., E. Pittsburgh, Penn.

BRAKE LININGS

Johns-Manville, Inc., New York, N. Y.—asbestos
Manhattan Rubber Mfg. Co., Passiac, N. J.—for all industrial purposes
Thermoid Rubber Co., Trenton, N. J.—for cranes, dredges and hoists

BRICK DRYING CARS

H. D. Conkey & Co., Mendota, Ill.
Jackson & Church Co., Saginaw, Mich.

BRICK MACHINERY

Besser Sales Co., Chicago, Ill.—concrete
The Bonnot Co., Canton, O.
Concrete Equipment Co., Holland, Mich.—concrete
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Ideal Concrete Machinery Co., Cincinnati, O.—concrete—see page 255
Jackson & Church Co., Saginaw, Mich.—sand-lime)
Komnick Machinery Co., Detroit, Mich.—sand-lime
Lancaster Iron Works, Inc., Lancaster, Penn.
Shope Brick Co., Portland, Ore.—concrete
L. V. Thayer, New York, N. Y.—concrete
Wert Mfg. Co., Chicago, Ill.—concrete
Helm Brick Machine Co., Cadillac, Mich.—concrete

BRICK PRESSES

Anderson Foundry & Machine Co., Anderson, Ind.
Besser Sales Co., Chicago, Ill.
Jackson & Church Co., Saginaw, Mich.
Shope Brick Co., Portland, Ore.
L. V. Thayer, New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183

BUCKETS—(Clamshell, Orangepeel, Dragline)

Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Bay City Dredge Works, Bay City, Mich.
Beach Mfg. Co., Charlotte, Mich.
Blaw-Knox Co., Pittsburgh, Penn.
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
The Browning Co., Cleveland, O.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—see page 199
Forsythe Bros., New York, N. Y.
L. B. Foster Co., Pittsburgh, Penn.—see page 252
Hadfield - Penfield Steel Co., Bucyrus, O.—see pages 182-183
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
The Hayward Co., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Industrial Works, Bay City, Mich.—all excepting orangepeels—see page 55
Joshua Hendy Iron Works, San Francisco, Cal.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Koppel Industrial Car & Equip. Co., Koppel, Penn.
The Lakewood Engineering Co., Cleveland, O.
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Marion Steam Shovel Co., Marion, O.—see page 59
Mead-Morrison Mfg. Co., East Boston, Mass.
McMyler-Interstate Co., Cleveland, O.—see page 189

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Northwest Eng. Co., Chicago, Ill.—insert between pages 2-3
Orton & Stenbrenner Co., Chicago, Ill.—see page 53
Osgood Co., Marion, O.—see page 54
Owen Bucket Co., Cleveland, O.
Pawling & Harnischfeger Co., Milwaukee, Wis.
James B. Seaverns Co., Chicago, Ill.—see inside back cover
Universal Crane Co., Cleveland, O.
G. H. Williams Co., Erie, Penn.
Page Eng. Co., Chicago, Ill.
The Thew Shovel Co., Lorain, O.—see page 180

BUCKETS—Elevator and Conveyor

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights—see page 209
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Austin Machinery Corp., Toledo, O.
Baker Car Co., Harriman, Tenn.
Beach Mfg. Co., Charlotte, Mich.
Biehl Iron Works, Inc., Reading, Penn.
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
C. O. Bartlett & Snow Co., Cleveland, O.
Caldwell, H. W., & Son Co., Chicago, Ill.—see page 37
Chain Belt Co., Milwaukee, Wis.
Columbia Steel Tank Co., St. Louis, Mo.
Columbus Conveyor Co., Columbus, O.
Conveyor Corp. of America, Chicago, Ill.
Dodge Mfg. Corp., Mishawaka, Ind.
Doolittle-Stephens, Ltd., Hagersville, Ont., Can.—see page 191
Ellicott Machine Corp., Baltimore, Md.
Forsythe Bros., New York, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machinery Co., Kennett Sq., Penn.—see page 40
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—see page 188
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Hesse-Ersted Iron Works, Portland, Ore.
Howe Chain Co., Muskegon, Mich.—see page 221
S. Howes Co., Silver Creek, N. Y.
Hunt Co., C. W., Staten Island, N. Y.
Inland Engineering Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Kennedy Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
The Lakewood Engineering Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Cal.
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
McLanahan Stone Machine Co., Hollidaysburg, Penn.—see page 250
Mead-Morrison Mfg. Co., E. Boston, Mass.
Moore & Moore, Inc., Reading, Penn.
Mullins Body Corp., Salem, O.
Palmer-Bee Co., Detroit, Mich.—see page 217
Penn Foundry & Mfg. Co., Reading, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Robins Conveying Belt Co., New York, N. Y.—see page 14
James B. Seaverns Co., Chicago, Ill.—see inside back cover
T. L. Smith Co., Milwaukee, Wis.
Smith Eng. Works, Milwaukee, Wis.—see page 239
Standard Steel Works, North Kansas City, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—steel and cast iron—see page 194
W. Toepfer & Sons, Milwaukee, Wis.—see page 245
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Wellman-Seaver-Morgan Co., Cleveland, O.
Union Chain & Mfg. Co., Sandusky, O.—see page 256

BUILDING CONSTRUCTORS

Blaw-Knox Co., Pittsburgh, Penn.
Morgan Eng. Co., Alliance, O.—see page 239
H. Miscampbell, Duluth, Minn.—see pages 30-31
Penn. Bridge Co., New York. N. Y.
James B. Seaverns Co., Chicago, Ill.—see inside back cover
Southwestern Engineering Co., Los Angeles, Calif.
The Stearns-Roger Mfg. Co., Denver, Colo.
Truscon Steel Co., Youngstown, O.
Wisconsin Bridge and Iron Co., N. Milwaukee, Wis.

BUHR MILLS

Butterworth & Lowe, Grand Rapids, Mich.—see page 250
J. B. Ehrsam & Sons Co., Enterprise, Kans.—see page 251
Munson Mill Machy Co., Utica, N. Y.—see page 253
Sturtevant Mill Co., Boston, Mass.—see page 257

BUHR STONES

J. B. Ehrsam & Sons Co., Enterprise, Kans.—see page 251
Munson Mill Machinery Co., Utica, N. Y.—see page 253
The Orville Simpson Co., Cincinnati, O.—see page 49

CABLE

(See Rope, Wire Rope, Wire and Cable, Electrical)
American Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—see page 254
Beach Mfg. Co., Charlotte, Mich.
Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Mfg. Corp., Mishawaka, Ind.
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 288
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha. Wis.
George C. Moon Co., Garwood, N. J.
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—see page 12

CABLE (Manilla Drilling)
See Manilla Rope

CABLEWAYS

American Mfg. & Eng. Co., Kalamazoo, Mich.—see page 242
American Steel & Wire Co., Chicago, Ill.—see page 254
Bedford Fdry. & Mach. Co., Bedford, Ind.
Blaw-Knox Co., Pittsburgh, Penn.—automatic single rope
Broderick and Bascom Rope Co., St. Louis, Mo.
Clyde Iron Works, Duluth, Minn.
S. Flory Mfg. Co., Bangor, Penn.—see page 257
Godfrey Conveyor Co., Elkhart, Ind.
Hazard Mfg. Co., Wilkes-Barre, Penn.—electric
Joshua Hendy Iron Works, San Francisco, Calif.
John T. Horton Co., Inc., New York, N. Y.
Interstate Equipment Co., New York, N. Y.—see page 22
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Macwhyte Co., Kenosha. Wis.
Mansfield Eng. Co., Indianapolis, Ind.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
Railway & Industrial Engineering Co., Greensburg, Penn.—rocking
John A. Roebling's Sons Co., Trenton, N. J.
Sauerman Bros., Chicago, Ill.—excavating, dragline and slackline—see page 229
Scofield-Burkett Construction Co., Macon, Ga.
Thomas Elevator Co., Chicago, Ill.—see page 17

CALCINING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Process Co., New York, N. Y.—see inside back cover
Arnold & Weigel, Woodville, O.—see page 26
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Bonnot Co., Canton, O.
Butterworth & Lowe, Grand Rapids, Mich.—see page 250
L. R. Christie Co., Pittsburgh, Penn.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Kennedy-Van Saun Mfg. & Engineering Corp., New York, N. Y.—see page 4
Louisville Drying Machy Co., Louisville, Ky.
McGann Mfg. Co., York, Penn.—see page 29
H. Miscampbell, Duluth, Minn.—see pages 30-31
Reeves Bros. Co., Alliance, O.—see page 228
Ruggles-Coles Eng. Co., New York, N. Y.—see page 187
Schaffer Eng. Co., Pittsburgh, Penn.—see page 28
Steacy-Schmidt Co., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233

CALCIUM CARBIDE

Carbic Mfg. Co., Duluth, Minn.
Shawingan Products Corp., New York, N. Y.

CALORIMETERS (For Coal Testing)

E. H. Sargent & Co., Chicago, Ill.

CAPSTANS—See Winches

CARRIERS

H. D. Conkey & Co., Mendota, Ill.
Conveyor Corp. of America, Chicago, Ill.
The Greenville Mfg. Co., Greenville, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover

CARS

(Dump, Industrial, Quarry, Push, Etc.)
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
American Car and Foundry Co., Chicago, Ill.
Austin Mfg. Co., Chicago, Ill.—see page 247
Austin Western Road Mach. Corp., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Penn.
Biehl Iron Works, Inc., Reading, Penn.
The Buda Co., Chicago, Ill.
Car Dumper & Equipment Co., Chicago, Ill.
The C. S. Card Iron Works Co., Denver, Colo.
H. D. Conkey & Co., Mendota. Ill.
The O. H. Davidson Equipment Co., Denver, Colo.
The Differential Steel Car Co., Findlay, O.—side dump
Exeter Machine Works, Inc., West Pittston, Penn.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Easton Car & Construction Co., Easton, Penn.—all types—see page 204
Gehret Bros., Bridgeport, Penn.
Good Roads Machinery Co., Inc., Kennett Sq., Penn.—dump—see page 40
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
The Geo Haiss Mfg. Co., Inc., New York, N. Y.
Heil Co., Milwaukee, Wis.
Joshua Hendy Iron Works, San Francisco, Calif.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Hockensmith Wheel & Mine Car Co., Penn, Penn.
Hyman-Michaels Co., Chicago, Ill.—see page 251
Hunt Co., C. W. Staten Island, N. Y.
Insley Mfg. Co.. Indianapolis, Ind.—rocker dump
International Clay Machinery Co., Dayton, O.—all kinds
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Kenova Mine Car Co., Kenova, W. Va.
Kentucky Wagon Mfg. Co., Louisville, Ky.
Komnick Machinery Co., Detroit, Mich.
Koppel Industrial Car & Equipment Co., Koppel, Penn.—all types

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Lake Shore Engine Works, Marquette, Mich.
The Lakewood Engineering Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Magor Car Corp., New York, N. Y.
Manitowoc Shipbuilding Corp., Manitowoc, Wis.—see page 50
Ogden Iron Works Co., Ogden, Utah
Ottumwa Iron Works, Ottumwa, Iowa—see page 242
Penn. Foundry & Mfg. Co., Reading, Penn.
Sanford Day Iron Works, Knoxville, Tenn.—all kinds
James B. Seaverns Co., Chicago, Ill.—see inside back cover
Southern Wheel Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Watt Mining Car Wheel Co., Barnsville, O.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Western Wheeled Scraper Co., Aurora, Ill.—see page 203

CAR DUMPERS

Bay City Foundry & Machine Co., Bay City, Mich.
Car Dumper & Equipment Co., Chicago, Ill.
Fairmont Mining Machine Co., Fairmont, W. Va.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
The McMyler-Interstate Co., Cleveland, O.—see page 189
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Robins Conveying Belt Co., New York, N. Y.—see page 14
James B. Seaverns Co., Chicago, Ill.—see inside back cover
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Wellman-Seaver-Morgan Co., Cleveland, O.

CAR PULLERS

The Aldon Co., Chicago, Ill.
The American Hoist & Derrick Co., St. Paul, Minn.—see page 251
Bethlehem Ship Building Corp., Bethlehem, Penn.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Clyde Iron Works, Duluth, Minn.
Dodge Mfg. Co., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—see page 251
S. Flory Mfg. Co., Bangor, Pa.—see page 257
L. B. Foster Co., Inc., Pittsburgh, Pa.—see page 252
The Godfrey Conveyor Co., Elkhart, Ind.
Hunt, C. W., Co., Staten Island, N. Y.
Hyman-Michaels Co., Chicago, Ill.—see page 251
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mining Machine Co., Mountville, Pa.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Ottumwa Box Car Loader Co., Uttumwa, Ia.
Ottumwa Iron Wks., Ottumwa, Ia.—see page 242
Palmer-Bee Co., Detroit, Mich.—see page 217
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Thomas Elevator Co., Chicago, Ill.—see page 17
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
The Wellman-Seaver-Morgan Co., Cleveland, O.

CAR LINERS
(See Paper—for lining cars)

CAR REPLACERS

Aldon Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Koppel Industrial Car & Equip. Co., Koppel, Penn.
Track Equipment Co., Huntington, W. Va.

CASINGS, Elevator—See Elevators

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Palmer-Bee Co., Detroit, Mich.—see page 217
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 222-223
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

CASTINGS

American Car and Foundry Co., Chicago, Ill.
American Manganese Steel Co., Chicago Heights, Ill.—manganese—see page 209
Bethlehem Steel Co., Bethlehem, Pa.
Bonnot Co., Canton, O.
Bucyrus Co., South Milwaukee, Wis.—steel—see page 23
Burch Plow Works Co., Crestline, O.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Davenport Loco. Wks., Davenport, Ia.—gray iron—see page 253
Electric Manganese Steel Co., Reading, Penn.—manganese—see page 213
Easton Car & Construction Co., Easton, Pa.—see page 204
The Falk Corp., Milwaukee, Wis.—see pages 182-183
Fuller-Lehigh Co., Fullerton, Pa.—see page 212
Hadfield-Penfield Steel Co., Bucyrus, O.—manganese—see pages 182-183
Hesse-Martin Iron Works, Portland, Ore.
Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.—gray iron
Indiana Foundry Co., Inc., Indiana, Pa.
Inland Engineering Co., Chicago, Ill.—manganese steel
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
W. A. Jones Fdry. & Mach. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Kenova Mine Car Co., Kenova, W. Va.
Kramer Bros. Foundry Co., Dayton, O.—gray iron—see page 244
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Lobdell Car Wheel Co., Wilmington, Del.
Los Angeles Foundry Co., Los Angeles, Calif.
Louisville Drying Machy. Co., Louisville, Ky.
Mackintosh-Hemphill Co., Pittsburgh, Penn.—see page 247
McGann Manufacturing Co., Inc., York, Pa.—gray iron—see page 29
The McLanahan Stone Machine Co., Hollidaysburg, Penn.—see page 250
The McMyler-Interstate Co., Cleveland, O.—see page 189
The Midvale Co., Philadelphia, Penn.—see page 48
Moore & Moore, Inc., Reading, Pa.—manganese
Morgan Engineering Co., Alliance, O.—see page 239
Munson Mill Machinery Co., Inc., Utica, N. Y.—gray iron—see page 253
Nortmann-Duffke Co., Milwaukee, Wis.—gray iron
Novo Engine Co., Lansing, Mich.
Pennsylvania Casting & Machine Co., Pittsburgh, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—manganese steel—see page 184
Philadelphia Steel & Iron Co., Philadelphia, Pa.—iron
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Engineering & Machine Co., Baltimore, Md.—iron, steel—see page 256
Reeves Bros. Co., Alliance, O.—see page 228
Robins Conveying Belt Co., New York, N. Y.—see page 14
Stroh Steel Hardening Process Co., Pittsburgh, Penn.
Steacy-Schmidt Mfg. Co., New York, N. Y.
H. N. Strait Mfg. Co., Kansas City, Mo.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel—see page 11
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—iron and steel—see page 233
Webb City & Carterville Foundry & Machine Co., Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219

CEMENT BRIQUET MOLDS

E. H. Sargent & Co., Chicago, Ill.

CEMENT, HIGH TEMPERATURE

Adams & Jewell, Rome, N. Y.
Ashland Fire Brick Co., Ashland, Ky.
Betson Plastic Fire Brick Co., Inc., Rome, N. Y.
Celite Products Co., Chicago, Ill.
A. P. Green Fire Brick Co., Mexico, Mo.
Harbison-Walker Refractories Co., Pittsburgh, Penn.—see page 51
Johns-Manville, Inc., New York, N. Y.
Laclede-Christy Co., St. Louis, Mo.
Quigley Furnace Specialties Co., Inc., New York, N. Y.
The Wahl Refractory Products Co., Fremont, O.

CEMENT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
J. R. Alsing Engineering Co., New York, N. Y.
American Process Co., New York, N. Y.—see inside back cover
The Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Penn.—see page 52
L. R. Christie Co., Pittsburg, Penn.
Duff Patents Co., Inc., Pittsburgh, Penn.
Fuller-Lehigh Co., Fullerton, Pa.—see page 212
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hardinge Co., New York, N. Y.—see page 3
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Komnick Machy. Co., Detroit, Mich.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
H. Miscampbell, Duluth, Minn.—see pages 30-31
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—see pages 42-43
The Reeves Bros. Co., Alliance, O.—see page 228
Richardson Scale Co., Passaic, N. J.
Ruggles-Coles Engineering Co., New York, N. Y.—see page 187
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
Sturtevant Mill Co., Boston, Mass.—see page 257
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 233
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—see pages 34-35

CEMENT MILL CONTRACTORS

Allis-Chalmers Mfg. Co. Milwaukee, Wis.—see page 179
Austin Co., Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
Buckbee, J. C., & Co., Chicago, Ill.—see page 256
Burrell Eng. & Const. Co., Chicago, Ill.—see page 237
Cowham Eng. Co., Chicago, Ill.
Fuller Eng. Co., Fullerton, Penn.
Kennedy-Van Saun Mfg. & Eng. Co., New York, N. Y.—see page 4
MacDonald Engineering Co., Chicago, Ill.
Meade, R. K., & Co., Baltimore, Md.
Manitowoc Shipbuilding Corp., Manitowoc, Wis.—see page 50
Reeves Bros. Co., Alliance, O.—see page 228
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

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CEMENT MILL REPAIRS

American Manganese Steel Co., Chicago, Heights, Ill.—see page 209
Ann Arbor Foundry Co., Ann Arbor, Mich.
The Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Penn.—see page 52
Cowham Eng. Co., Chicago, Ill.
Electric Manganese Steel Co., Reading Penn.—see page 213
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hardinge Co., New York, N. Y.—see page 3
Kennedy-Van Saun Mfg. & Eng. Co., New York, N. Y.—see page 4
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Moore & Moore, Inc., Reading, Penn.
Philadelphia Steel & Iron Co., Philadelphia, Penn.
Reeves Bros. Co., Alliance, O.—see page 228
Stroh Steel Hardening Process Co., Pittsburgh, Penn.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

CEMENT PACKERS

Bates Valve Bag Co., Chicago, Ill.
S. Howes Co., Inc., Silver Creek, N. Y.
Modern Valve Bag Co., Trenton, N. J.

CEMENT TESTING APPARATUS

Will Corp., Rochester, N. Y.
Riehle Bros. Testing Mach. Co., Philadelphia, Penn.
E. H. Sargent & Co., Chicago, Ill.
W. S. Tyler Co., Cleveland, Ohio—see page 257

CHAIN

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
The Baldwin Chain & Mfg. Co., Worcester, Mass.—all types
Beach Mfg. Co., Charlotte, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
The Carroll Chain Co., Columbus, O.—welded steam shovel, dredge, crane and sling—see page 255
Chain Belt Co., Milwaukee, Wis.
Colonial Supply Co., Pittsburgh, Penn.
The Columbus-McKinnon Chain Co., Columbus, O.—welded steam shovel, power and dredge—see page 255
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Hadfield-Penfield Steel Co., Bucyrus, O.—Manganese—see pages 182-183
The George Haiss Mfg. Co., Inc., New York, N. Y.
Howe Chain Co., Muskegon, Mich.—all kinds—see page 221
Inland Engineering Co., Chicago, Ill.—all kinds
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Link-Belt Co., Chicago, Ill.—all kinds—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manganese Steel Forge Co., Philadelphia, Penn.—manganese—see page 257
The Medart Co., St. Louis, Mo.
Moore & Moore, Inc., Reading, Penn.
Morse Chain Co., Ithaca, N. Y.—all kinds—see page 10
Newhall Chain Forge & Iron Co., New York, N. Y.—welded steam shovel
Palmer-Bee Co., Detroit, Mich.—see page 217
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
The Stearns Conveyor Co., Cleveland, O.—see page 250
Stephens-Adamson Mfg. Co., Aurora, Ill.—conveyor and drive—see page 194
Sturtevant Mill Co., Boston, Mass.—see page 257
S. G. Taylor Chain Co., Chicago, Ill.—steam shovel, dredge, crane and conveyor—see page 202
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—elevating and conveying—see page 11
Union Chain & Mfg. Co., Sandusky, O.—all kinds—see page 256
United States Chain & Forging Co., Pittsburgh, Penn.—welded steam shovel
Webster Mfg. Co., Chicago, Ill.—all kinds—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

CHAIN GRATES

Automatic Furnace Co., Dayton, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183

CHANNELERS

Sullivan Machinery Co., Chicago, Ill.—see page 216

CHEMICALS

Eimer & Amend Co., New York, N. Y.
E. H. Sargent & Co., Chicago, Ill.

CHEMISTS

Arnold & Weigel, Woodville, O.—see page 26
Geo. Borrowman, Ph.D., Chicago, Ill.
Dearborn Chemical Co., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.
Eimer & Amend, New York, N. Y.
Robt. W. Hunt & Co., Chicago, Ill.—see page 254
H. E. Wiedemann, St. Louis, Mo.

CHIMNEYS

Heine Boiler Co., St. Louis, Mo.
Littleford Bros., Cincinnati, O.
The Reeves Bros. Co., Alliance, O.—see page 228
Weber Chimney Co., Chicago, Ill.
Wiederholdt Construction Co., New York, N. Y.

CHUTES

Advance Fdy. Co., Dayton, O.—"Strenes" metal—see page 56
Biehl Iron Works, Inc., Reading, Penn.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
C. S. Card Iron Works, Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
The Good Roads Machinery Co., Inc., Kennett Square, Penn.—see page 40
Gehret Bros., Bridgeport, Penn.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Hunt C. W. & Co., Staten Island, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Johns-Manville, Inc., New York, N. Y.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246.
The Robins Conveying Belt Co., New York, N. Y.—see page 14
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 257
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

CLAMPS

Dixon Valve & Coupling Co., Philadelphia, Penn.
Knox Mfg. Co., Philadelphia, Penn.—see page 201

CLASSIFIERS

Allis-Chalmers Mfg. Milwaukee, Wis.—see page 179
The Allen Cone Co., El Paso, Texas
Colorado Iron Works Co., Denver, Colo.
Deister Machine Co., Fort Wayne, Ind.
The Dorr Co., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
W. S. Tyler Co., Cleveland, O.—see page 257

CLUTCHES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The Baldwin Chain & Mfg. Co., Worcester, Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
W. E. Caldwell Co., Louisville, Ky.—friction
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—magnetic
Dodge Mfg. Co., Mishawaka, Ind.
The Hanson Clutch & Machinery Co., Tiffin, O.—friction
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—friction—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
O. K. Clutch & Mfg. Co., Columbia, Penn.—friction
Palmer-Bee Co., Detroit, Mich.—see page 217
Plamondon Mfg. Co., Chicago, Ill.
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Western Eng. & Mfg. Co., Chicago, Ill.
T. B. Wood's Sons Co., Chambersburg, Penn.

COAL

Amherst Fuel Co., Cincinnati, O.
Bertha-Consumers Co., Pittsburgh, Penn.—see page 257
Maher Collieries Co., Cleveland, O.
Peerless Coal Co., Philadelphia, Pa.

COAL PULVERIZING EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Process Co., New York, N. Y.—see inside back cover
American Pulverizer Co., St. Louis, Mo.
Bonnot Co., Canton, O.
Bethlehem Steel Co., Bethlehem, Penn.
Bradley Pulverizer Co., Allentown, Penn.—see page 52
L. R. Christie Co., Pittsburgh, Penn.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—see page 188
Grindle Fuel Equipment Co., Harvey, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hardinge Co., New York, N. Y.—see page 3
Jeffery Mfg. Co., Columbus, O.—see pages 226-227
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
K.-B. Pulverizer Co., New York, N. Y.—see page 254
McGann Mfg. Co., York, Pa.—see page 29
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
The Northern Blower Co., Cleveland, O.
Orton & Steinbrenner Co., Chicago, Ill.—see page 53
Palmer-Bee Co., Detroit, Mich.—see page 217
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—see pages 42-43
Ruggles-Coles Engineering Co., York, Penn.—see page 187
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
E. H. Stroud & Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—see pages 34-35

COLORS (For Cement and Mortar)

C. K. Williams, Easton, Pa.—see page 256

COMPRESSED AIR LINE FITTINGS

Dixon Valve & Coupling Co., Philadelphia, Penn.
Knox Mfg. Co., Philadelphia, Pa.—see page 201

COMPRESSORS

(See Air Compressors)

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CONCENTRATORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
C. G. Buchanan Co., Inc., New York, N. Y.—see pages 18-19
Colorado Iron Works Co., Denver, Colo.
Deister Concentrator Co., Ft. Wayne, Ind.
Hadfield-Penfield Steel Co., Bucyrus, Ohio—see pages 182-183
Hardinge Co., New York, N. Y.—see page 3
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Magnetic Mfg. Co., Milwaukee, Wis.—see page 257
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—see page 250
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Ruggles-Coles Eng. Co., New York, N. Y.—see page 187
Southwestern Engineering Co., Los Angeles, Calif.
Stearns-Rogers Mfg. Co., Denver, Colo.
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.

CONES—Sand

The Allen Cone Co., El Paso, Texas—for dewatering, sand washing, stockpile building, classifying, thickening, etc.
W. H. K. Bennett, M. E., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Smith Eng. Wks., Milwaukee Wis.—see page 239
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.

CONCRETE MIXERS
See Mixers

CONCRETE MOLDS—All Kinds

Anchor Concrete Machy. Co., Adrian, Mich.—see page 232
Automatic sealing vault Co., Peru, Ind.—burial vault
Besser Sales Co., Chicago, Ill.
Concrete Equipment Co., Holland, Mich.
Concrete Tile Machy. Co., Cicero, Ill.—see page 224
Doswell & Kover, Ft. Wayne, Ind.—burial vault
W. E. Dunn Mfg. Co., Holland, Mich.
L. Hansen Co., Kansas City, Mo.
Helm Brick Machine Co., Cadillac, Mich.
Ideal Concrete Machinery Co., Cincinnati, O.—see page 255
Wert Mfg. Co., Chicago, Ill.

CONCRETE PRODUCTS MACHINERY

Anchor Concrete Machy. Co., Adrian, Mich.—see page 232
Besser Sales Co., Chicago, Ill.
W. E. Dunn Manufacturing Co., Holland, Mich.
Ideal Concrete Machinery Co., Cincinnati, O.—see page 255
Kent Machine Co., Kent, O.
Thos. W. Noble Co., Chicago, Ill.
Shope Brick Co., Portland, Ore.
Wert Mfg. Co., Chicago, Ill.

CONTROLLERS—Automatic Temperature

Brown Instrument Co., Philadelphia, Penn.
Equitherna Control Corp., New York, N. Y.
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Kieley & Mueller, New York, N. Y.
Leeds and Northrup Co., Philadelphia, Penn.
Powers Regulator Co., Chicago, Ill.
Thwing Instrument Co., Philadelphia, Penn.
Wilson-Maulen Co., New York, N. Y.

CONTROLLERS—Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Duro Metal Products Co., Chicago, Ill.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Morgan Eng. Co., Alliance, O.—see page 239
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Penn.

CONVEYORS

Acme Road Machinery Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co. Milwaukee, Wis.—see page 179
Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—see page 247
Austin-Western Road Machinery Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York(N. Y.—see page 46
Barber-Greene Co., Aurora, Ill.—self-propelled and belt
The C. O. Bartlett & Snow Co., Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
B. and W. Oil-less Conveyor Co., Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland, O.—belt and chain—see page 1
Buffalo Weaving & Belting Co., Buffalo, N. Y.
C. G. Buchanan Co., Inc., New York, N. Y.—see pages 18-19
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Chain Belt Co., Milwaukee, Wis.
Columbus Conveyor Co., Columbus, O.
Conveyors Corp. of America, Chicago, Ill.—steam jet, monorail, cableway
Dodge Mfg. Corp., Mishawaka, Ind.
Dorr Co., New York, N. Y.
W. E. Dunn Mfg. Co., Holland, Mich.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Ebersol Eng. Co., Blue Ball, Lancaster Co., Penn.—see page 244
Exeter Machine Works, Inc., West Pittston, Penn.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Gifford-Wood Co., Hudson, N. Y.—all kinds
Gandy Belting Co., Baltimore, Md.—see page 61
The Godfrey Conveyor Co., Elkhart, Ind.
B. F. Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Good Roads Machinery Co., Inc., Kennett Square, Penn.—see page 40
The Greenville Mfg. Co., Greenville, O.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 188
Guarantee Construction Co., New York, N. Y.—pneumatic, belt and flight
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
S. Howes Co., Silver Ceek, N. Y.
The Geo. Haiss Mfg. Co., New York, N. Y.—portable, belt
The Hamilton Mfg. Co., Columbus, O.—portable stripping
Hesse-Martin Iron Works, Portland, Ore.
Howe Chain Co., Muskegon, Mich.—see page 221
Wilbur G. Hudson Corp., New York, N. Y.
C. W. Hunt & Co., Inc., Staten Island, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.
Jackson & Church Co., Saginaw, Mich
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Komnick Machinery Co., Detroit, Mich.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—belt—see page 4
Lansing Motor & Pump Co., Inc., Lansing, Mich.—belt
Lewistown Foundry & Machine Co., Lewistown, Penn.—see pages 214-215
Link-Belt Co., Chicago, Ill.—screw, portable, helicoid and belt—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
McKinney-Harrington Co., North Chicago, Ill.—steel bucket and portable
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—see page 250
W. F. Mosser & Son, Allentown, Penn.—screw
National Conveying Equipment Corp., Chicago, Ill.—portable
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—portable—see page 246
The Orville Simpson Co., Cincinnati, O.—see page 49
Ottumwa Box Car Loader Co., Ottumwa, Ia.—flexible
Palmer-Bee Co., Detroit, Mich.—see page 217
Portable Machinery Co., Passaic, N. J.—portable, belts
Robins Conveying Belt Co., New York, N. Y.—see page 14
Sandvik Steel, Inc., New York, N. Y.
James B. Seaverns Co., Chicago, Ill.—pan—see inside back cover
Smith Engineering Works, Milwaukee, Wis.—see page 239
Specialty Engineering Co., Philadelphia, Penn.—belt
Steacy-Schmidt Mfg. Co., York, Penn.
The Stearns Conveyor Co., Cleveland, O.—belt, apron, screw and drag—see page 250
Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Sturtevant Mill Co., Boston, Mass.—all kinds—see page 257
The Sunbury Mfg. Co., Sunbury, O.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Union Engineering Co., Cleveland, O.
Universal Crusher Co., Cedar Rapids, Ia.—see page 206
Universal Road Machy. Co., Kingston, N. Y.—see page 250
Webb City & Carterville Foundry & Machine Wks., Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—see pages 34-35

CONVEYORS—Monorail and Cableway

Brown Hoisting Machine Co., Cleveland, O.—see page 1
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constr. Co., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Palmer-Bee Co., Detroit, Mich.—see page 217
James B. Seaverns Co., Chicago, Ill.—see inside back cover

CONVEYING SYSTEMS—Pneumatic

Allen Eng. & Mfg. Co., Savannah, Ga.
The Dust Recovering & Conveying Co., Cleveland, O.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Guarantee Construction Co., New York, N. Y.
Holley Pneumatic Systems, Inc., New York, N. Y.
The Northern Blower Co., Cleveland, O.

COOLERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Process Co., New York, N. Y.—see inside back cover
Arnold & Weigel, Woodville, O.—see page 26
C. O. Bartlett and Snow Co., Cleveland, O.
Bonnot Co., Canton, O.
L. R. Christie Co., Pittsburgh, Penn.
Duff Patents Co., Inc., Pittsburgh, Penn.
Kennedy-Van Saun Eng. & Mfg. Corp., New York, N. Y.—see page 4
Louisville Drying Machy. Co., Louisville, Ky.
Manitowoc Shipbuilding Corp., Manitowoc, Wis.—see page 50
McGann Mfg. Co., York, Pa.—see page 29
H. Miscampbell, Duluth, Minn.—lime—see pages 30-31
W. F. Mosser & Son, Allentown, Penn.
The Reeves Bros. Co., Alliance, O.—see page 228
Ruggles-Coles Engineering Co., New York, N. Y.—see page 187
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
Southwestern Engineering Co., Los Angeles, Calif.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233

CORDEAU-BICKFORD FUSE

Ensign-Bickford Co., Simsbury, Conn.—see page 200

COUPLINGS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The Baldwin Chain & Mfg. Co., Worcester, Mass.

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Chain Belt Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
DeLaval Steam Turbine Co., Trenton, N. J.
Dixon Valve and Coupling Co., Philadelphia, Pa.
S. R. Dresser Mfg. Co., Bradford, Penn.—steel pipe
The Electric Controller & Mfg. Co., Cleveland, O.—flexible
Falk Corp., Milwaukee, Wis. (flexible)
Farrell Foundry & Machine Co., Buffalo, N. Y.—flexible
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.—see page 15
The B. F. Goodrich Co., Akron, O.
Hardscog Wonder Drill Co., Ottumwa, Ia.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Ingersoll-Rand Co., New York, N. Y.
D. O. James Mfg. Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago, Ill.
The Knox Manufacturing Co., Philadelphia, Pa.—see page 201
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Mulconroy Co., Inc., Philadelphia, Penn.—hose.
R. D. Nuttall Co., Pittsburgh, Penn.
O. K. Clutch & Machinery Co., Columbus, Penn.
Palmer-Bee Co., Detroit, Mich—see page 217
A. Plamondon Mfg. Co., Chicago, Ill.
Rubber Insulated Metals Corp., New York, N. Y.
Sanford-Day Iron Works, Inc.—Knoxville, Tenn.
Smith and Serrell, Newark, N. J.
Terry Steam Turbine Co., Hartford, Conn.—flexible
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Wood Drill Works, Paterson, N. J.—hose
T. B. Wood's Sons Co., Chambersburg, Penn.

CRANES

American Hoist & Derrick Co., St. Paul, Minn.—locomotive—see page 251
Austin Machinery Corp., Toledo, O.
The Baker R. & L. Co., Cleveland, O.—electric portable
Bay City Dredge Works, Bay City, Mich.—gasoline or electric clamshell
Bay City Foundry & Machine Co., Bay City, Mich.—motor truck
Bedford Foundry & Machine Co., Bedford, Ind.
Birmingham Rail & Locomotive Co., Birmingham, Ala.
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
The Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—see page 23
The Byers Machine Co., Ravenna, O.—auto-cranes, full circle cranes—see page 199
The Champion Engineering Co., Kenton, O.—overhead traveling
Curtis Pneumatic Mach. Co., St. Louis, Mo.—see page 257
Dobbie Foundry & Machine Co., Niaraga Falls, N. Y.
Erie Steam Shovel Co., Erie, Penn.—see page 241
Forsythe Bros., New York, N. Y.—steam, locomotive and gasoline
General Electric Co., Schenectady, N. Y.
The Hayward Co., New York, N. Y.—gantry
Hunt, C. W. Co., Staten Island, N. Y.
Industrial Works, Bay City, Mich.—steam, gas, crawling, tractor, locomotive, dragline operation, pillar—see page 55
Koehring Co., Milwaukee, Wis. — crawler — see pages 38-39
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Cal.
Manning, Maxwell & Moore, Inc., New York, N. Y.
The Marion Steam Shovel Co., Marion, O.—see page 59
Maris Brothers, Inc., Philadelphia, Penn.—electric, monorail
McMyler Interstate Co., Cleveland, O.—see page 189
Morgan Engineering Co., Alliance, O.—overhead traveling gantry and jib—see page 239
Northern Engineering Works, Detroit, Mich.—electric traveling, monorail grab bucket
Northwest Engineering Co., Chicago, Ill.—crawler, gasoline, electric—see insert between pages 2-3
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Pawling and Harnischfeger Co., Milwaukee, Wis.—portable crawler, ganty and overhead
Penn Bridge Co., New York, N. Y.—gasoline tractor
James B. Seaverns Co., Chicago, Ill.—locomotive, steam, electric, portable—inside back cover
The Thew Shovel Co., Lorain, O.—steam, gasoline and electric—see page 180
Toledo Crane Co., Bucyrus, O.—overhead electric traveling
Yale & Towne Mfg. Co., Stamford, Conn.—hand-traveling
United States Crane Co., Chicago, Ill.—locomotive
The Universal Crane Co., Cleveland, O.—motor truck and railroad flat car
The Wellman-Seaver-Morgan Co., Cleveland, O.—special
Whiting Corporation, Harvey, Ill.—electric traveling and bucket handling
Wright Mfg. Co., Lisbon, O.—hand traveling

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Stearns-Roger Mfg. Co., Denver, Colo.
Stevenson Co., Wellsville, O.
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Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
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Webb City & Carterville Foundry & Machine Works, Webb City, Mo.—jaw
Western Wheeled Scraper Co., Aurora, Ill.—portable—see page 203
O. B. Wise Pulverizer Co., Knoxville, Tenn.

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American Pulv. Co., St. Louis, Mo.
C. O. Bartlett & Snow Co., Cleveland, O.
The Bossert Corp., Utica, N. Y.
Dixie Mchy. Mfg. Co., St. Louis, Mo.
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Webb City & Cartersville Fdy. & Mach. Co., Webb City, Mo.

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Moore & Moore, Inc., Reading, Penn.
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S. Howes Co., Silver Creek, N. Y.
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Beckwith Machinery Co., Pittsburgh, Penn.—all types
Bedford Foundry & Machine Co., Bedford, Ind.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
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Clyde Iron Works, Duluth, Minn.
Dobbie Foundry & Machine Co., Niaraga Falls, N. Y.
S. Flory Mfg. Co., Bangor, Penn.—see page 257
Forsythe Bros., New York, N. Y.—steel and wood
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John T. Horton, Inc., New York, N. Y.
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Joshua Hendy Iron Works, San Francisco, Calif.
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J. S. Mundy Hoisting Engine Co., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
National Iron Co., Duluth, Minn.
Pawling and Harnischfeger Co., Milwaukee, Wis.
Penn Bridge Co., New York, N. Y.—all types
The Security Engineering Sales Co., Duluth, Minn.—stationary and portable
Superior Iron Works, Superior, Wis.
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Bay City Dredge Works, Bay City, Mich.
The Browning Co., Cleveland, O.
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W. H. K. Bennett, M. E., Chicago, Ill.
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Morris Machine Works Baldwinsville, N. Y.—hydraulic
J. S. Mundy Hoisting Engine Co., Newark, N. J.
The Norbom Engineering Co., Darby, Penn.—hydraulic
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Manning, Maxwell & Moore, Inc., New York, N. Y.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
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Dodge Mfg. Co., Mishawaka, Ind.
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Western Valve Bag Co., Chicago, Ill.—gear and silent chain

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Draper Mfg. Co., Cleveland, O.
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The Ohio Corrugating Co., Warren, O.—steel
The Petroleum Iron Works Co., Sharon, Penn.—steel
Pittsburgh Steel Drum Co., Pittsburgh, Penn.—steel
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The Bonnot Co., Canton, O.—rotary direct fired
Buckeye Dryer Co., Chicago, Ill.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Chicago Bridge & Iron Works, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Penn.
Colorado Iron Works, Denver, Colo.
Coatsville Boiler Works, Philadelphia, Penn.
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Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.

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H. D. Conkey & Co., Mendota, Ill.
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General Explosives Co. Chicago, Ill.
Giant Powder Co., San Francisco, Calif.
Grasselli Powder Co., Cleveland, O.—see page 208
Hercules Powder Co., Wilmington, Del.—see page 16
Illinois Powder Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Penn.

ECONOMIZERS—Fuel

Babcock & Wilcox Co. New York, N. Y.
Power Specialty Co., New York, N. Y.
B. F. Sturtevant Co., Boston, Mass.

ELECTRICAL BLOWERS—Portable

Clements Mfg. Co., Chicago, Ill.
Electric Vacuum Cleaner Co., Cleveland, O.
Northern Blower Co., Cleveland, O.

ELECTRICAL HAULAGE SYSTEMS

General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.
Woodford Engineering Co., Chicago, Ill.—see pages 249-252

ELECTRIC MOTORS, TRANSFORMERS, GENERATORS, DYNAMOS, ETC.

Alexander Milburn Co. Baltimore, Md.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Burke Electric Co., Erie, Penn.—see page 252
Crawford Mfg. Co., New York, N. Y.
Crocker-Wheeler Co., New York, N. Y.
De Laval Steam Turbine, Trenton, N. J.—turbo-generators

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The Electric Controller & Mfg. Co. Cleveland, O.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Kuhlman Electric Co., Bay City, Mich.—transformers
The Lincoln Electric Co., Cleveland, O.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
The Reliance Electric & Engineering Co., Cleveland, O.
Schramm, Inc., West Chester, Penn.
Sorgel Electric Co., Milwaukee, Wis.
Universal Motor Co., Oshkosh, Wis.
Wagner Electric Corp., St. Louis, Mo.
Western Electric Co., Chicago, Ill.
Westinghouse Electric and Mfg. Co., E. Pittsburgh, Penn.

ELEVATORS AND CASINGS

Acme Road Machy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Atlas Engineering Co. Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—see page 247
Austin-Western Road Machinery Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
Barber-Greene Co., Aurora, Ill.
The C. O. Bartlett & Snow Co. Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
C. G. Buchanan Co., Inc., New York, N. Y.—see pages 18-19
H. W. Caldwell & Son, Chicago, Ill.—see page 37
Chain Belt Co., Milwaukee, Wis.
The Dust Recovering & Conveying Co., Cleveland, O.
W. E. Dunn Mfg. Co., Holland, Mich.
Ebersol Eng. Co., Blue Ball, Lancaster Co., Penn.—see page 244
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Exeter Machine Works, Inc., West Pittston, Penn.
Galion Iron Works & Mfg. Co., Galion, O.
Gandy Belting Co., Baltimore, Md.—see page 61
Gifford-Wood Co., Hudson, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Penn.—see page 40
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 188
Guarantee Construction Co., New York, N. Y.
George Haiss Mfg. Co., Inc., New York, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Hesse-Ersted Iron Works, Portland, Ore.
Holly Pneumatic Systems, Inc., New York, N. Y.
Howe Chain Co., Muskegon, Mich.—see page 221
Wilbur G. Hudson Corp., New York, N. Y.
Interstate Equipment Co., New York, N. Y.—see page 22
Iowa Mfg. Co., Cedar Rapids, Ia.
The Jeffrey Mfg. Co. Columbus, O.—see pages 226-227
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Komnick Machy. Co., Detroit, Mich.
Lewistown Foundry & Machine Co., Lewistown, Penn.—see pages 214-215
Link-Belt Co., Chicago, Ill.—see pages 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
MacDonald Engineering Co., Chicago, Ill.
McKinney-Harrington Co., North Chicago, Ill.
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—see page 250
National Conveying Equipment Corp., Chicago, Ill.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246
The Orville Simpson Co., Cincinnati, O.—see page 49
Palmer-Bee Co., Detroit, Mich.—see page 217
Robins Conveying Belt Co., New York, N. Y.—see page 14
Rogers Foundry & Mfg. Co., Joplin, Mo.
Smith Engineering Works, Milwaukee, Wis.—see page 239
The T. L. Smith Co., Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Pa.
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
The Stearns Conveyor Co., Cleveland, O.—see page 250
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Sturtevant Mill Co., Boston, Mass.—see page 257
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Union Engineering Co., Cleveland, O.
Universal Crusher Co., Cedar Rapids, Ia.—see page 206
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Western Wheeled Scraper Co., Aurora, Ill.—see page 203
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—see pages 34-35

ENGINEERS

Acme Road Mchy. Co., Frankfort, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
J. R. Alsing, New York, N. Y.
American Process Co., New York, N. Y.—see inside back cover
Arnold & Weigel, Woodville, O.—see page 26
The Austin Co., Cleveland, O.
Austin Mfg. Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
W. H. K. Bennett, M. E., Chicago, Ill.
Besser Sales Co., Chicago, Ill.—concrete products plants
Bland Eng. Co., Minneapolis, Minn.
Brainard-Fairchild Engineering Co., Chicago, Ill.
Bradley Pulverizer Co., Allentown, Penn.—see page 52
C. G. Buchanan Co., Inc., New York, N. Y.—see pages 18-19
J. C. Buckbee Co., Chicago, Ill.—see page 256
Burrell Eng. & Constr. Co., Chicago, Ill.—see page 237
Butterworth & Lowe, Grand Rapids, Mich.—gypsum and gypsum plaster plants—see page 250
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
The Chapman Engineering Co., Mt. Vernon, O.
Chicago Engineering Associates, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Penn.
E. W. Cooper, Nashville, Tenn.
Coe Mfg. Co., Painesville, O.—gypsum wall board drying plants—see pages 230-231
Cowham Engineering Co., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.—chemical
Denver Engineering Works Co., Denver, Colo.
The Dorr Co., New York, N. Y.
Ebersol Eng. Co., Blue Ball, Lancaster Co., Penn.—see page 244
J. B. Ehrsam & Sons, Enterprise, Kan.—gypsum and gypsum plaster plants—see page 251
Exeter Machine Works, Inc., West Pittston, Penn.
The Foundation Co., New York, N. Y.
Fuller Engineering Co., Allentown, Penn.
General Electric Co., Schenectady, N. Y.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—complete lime plants
Guarantee Construction Co., New York, N. Y.
Gruendler Pat. Cr. & Pulv. Co. St. Louis, Mo.—see page 188
Geo. Haiss Mfg. Co., New York, N. Y.
Hardinge Co., New York, N. Y.—see page 3
James N. Hatch, Chicago, Ill.
Hetherington & Berner, Inc., Indianapolis, Ind.
Hill Clutch Machine & Fdy. Co., Cleveland, O.—see page 249
Holly Pneumatic Systems, Inc., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Robt. W. Hunt & Co., Chicago, Ill.—se page 254
Iowa Mfg. Co., Cedar Rapids, Ia.
The Improved Equipment Co., New York, N. Y.
Jackson & Church Co., Saginaw, Mich.
K-B Pulverizer Corp., New York, N. Y.—combustion and crushing—see page 254
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Kritzer Co. Chicago, Ill.—see inside back cover
The Lakewood Engineering Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—sand, gravel, stone, lime, etc.—see page 5 and back cover
MacDonald Engineering Co., Chicago, Ill.
McGann Mfg. Co., York, Pa.—see page 29
Richard K. Meade & Co., Baltimore, Md.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
H. Miscampbell, Duluth, Minn.—see pages 30-31
Morgan Eng. Co., Alliance, O.—see page 239
Morgan Construction Co., Worcester, Mass.—see page 238
Munson Mill Machinery Co., Inc., Utica, N. Y.—see page 253
Murray Iron Works Burlington, Ia.—power plant
The Northern Blower Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.—see page 217
Charles L. Pillsbury Co., Minneapolis, Minn.
Pittsburgh Testing Laboratory, Pittsburgh, Penn.—inspecting—chemical consulting
Poole Engineering & Machine Co., Baltimore, Md.—see page 256
Randolph Perkins Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—see page 14
Rogers Foundry & Mfg. Co., Joplin, Mo.
Ruggles-Coles Engineering Co., New York, N. Y.—see page 187
Wm. B. Scaife & Sons Co., Oakmont, Penn.
Schaffer Engineering Co., Pittsburgh, Penn.—see page 28
James B. Seaverns Co., Chicago, Ill.—see inside back cover
F. L. Smidth & Co., New York, N. Y.—cement plants—see pages 210-211
Southwestern Engineering Co., Los Angeles, Calif.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 257
W. Toepfer & Sons Co., Milwaukee, Wis.—sand-lime brick—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
The Union Engineering Co., Cleveland, O.
Universal Road Machinery Co., Kingston, N. Y.—stone, sand and gravel—see page 250
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Western Precipitation Co., Los Angeles, Calif.—chemical
Williams Pat. Crusher & Pulv. Co., St. Louis, Mo.—see pages 34-35
A. R. Wilfley & Sons, Denver, Colo.—see page 195
R. D. Wood & Co., Philadelphia, Penn.—see page 238
Worthington Pump and Machinery Corp., New York, N. Y.

ENGINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Blower Co., Detroit, Mich.—vertical steam
Anderson Foundry & Machine Co., Anderson, Ind.—oil
Earle C. Bacon, Inc., New York, N. Y.—hoisting—see page 46
Beaver Mfg. Co., Milwaukee, Wis.—see page 251
The Bessemer Gas Engine Co., Grove City, Penn.—gas, oil and diesel
Bethlehem Steel Co., Bethlehem, Penn.
The Brownell Co., Dayton, O.—steam
The Buckeye Machine Co., Lima, O.—oil
The Buda Co., Harvey, Ill.—gasoline
The Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.
Charter Gas Engine Co., Sterling, Ill.—gasoline, gas, kerosene and oil
Chicago Pneumatic Tool Co., New York, N. Y.—gas, oil
Climax Engineering Co., Clinton, Ia.—gasoline and kerosene for steam shovels, cranes, etc.—see insert between pages 2-3
Clyde Iron Works, Duluth, Minn.—gasoline, steam and belt hoisting
The Cook Motor Co., Delaware, O.—gas, gasoline and kerosene
De La Verne Engine Co., New York, N. Y.—diesel
Dodge Mfg. Co., Mishawaka, Ind.
Ellicott Machine Corp., Baltimore, Md.—dredge and marine
Erie City Iron Works, Erie, Pa.—steam
Erie Pump and Engine Works, Erie, Pa.—steam

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Fairbanks, Morse & Co., Chicago, Ill.—gasoline and diesel
Falk Corp., Milwaukee, Wis.
S. Flory Mfg. Co., Bangor, Penn.—hoisting—see page 257
Forsythe Bros., New York, N. Y.—hoisting
Good Roads Machinery Co., Kennett Square, Penn. see page 40
Hadfield-Penfield Steel Co., Bucyrus, O.—diesel—see pages 182-183
Hunt, C. W. Co., Staten Island, N. Y.—hoisting
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.—steam
Ideal Engine Co., Lansing, Mich.—gas
Ingersoll-Rand Co., New York, N. Y.—oil, steam and gas
Kahlenberg Bros. Co., Two Rivers, Wis.—oil
Lansing Motor & Pump Co., Lansing, Mich.—hoisting
Lidgerwood Mfg. Co., New York, N. Y.—steam, electric and gasoline—see page 243
McIntosh and Seymour Corp., Auburn, N. Y.—semi-diesel
Mine and Smelter Supply Co., Denver, Colo.—see pages 20-21
Morris Machine Works, Baldwinsville, N. Y.—steam
Muncie Oil Engine Co., Muncie, Ind.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
Murray Iron Works Co., Burlington, Ia.—steam
New Holland Machine Co., New Holland, Penn.—see page 254
Nordberg Mfg. Co., Milwaukee, Wis.—steam and oil
Novo Engine Co., Lansing, Mich.—gas
Orr & Sembower, Reading. Penn.—steam, electric and gasoline hoisting
The Otto Engine Works, Philadelphia, Penn.—gas, gasoline, oil
The Power Mfg. Co., Marion, O.—semi-diesel—see page 32
Schramm, Inc., West Chester, Penn.—gasoline
The T. L. Smith Co., Milwaukee, Wis.—gas
The St. Mary's Oil Engine Co., St. Charles, Mo.—diesel
H. N. Strait Mfg. Co., Kansas City, Mo.—gas
B. F. Sturtevant Co., Boston, Mass.—steam
Superior Iron Works, Superior, Wis.—steam
Universal Motor Co., Oshkosh, Wis.—gas
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Venn Severin Machine Co., Chicago, Ill.—oil
The Wellman-Seaver-Morgan Co., Cleveland, O.—gasoline
Worthington Pump & Machinery Corp., New York, N. Y.—oil and diesel

EXCAVATING MACHINERY

American Mfg. & Eng. Co., Kalamazoo, Mich.—calbeway—see page 242
Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Blaw-Knox Co., Pittsburgh, Penn.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—all types—see page 23
The Byers Machine Co., Ravenna, O.—derrick, drainage and trench—see page 199
Cable Excavator Co., Fernwood, Penn.—dragline cableway
Clyde Iron Wks., Duluth, Minn.
Erie Steam Shovel Co., Erie, Penn.—see page 241
L. B. Foster Co., Pittsburgh, Penn.—see page 252
Good Roads Machinery Co., Kennett Square, Penn.—see page 40
Hayward Co., New York, N. Y.
Hoar Shovel Co., Duluth, Minn.
Indianapolis Cable Excavator Co., Indianapolis, Ind.—slack line
Industrial Works, Bay City, Mich.—see page 55
Insley Mfg. Co., Indianapolis, Ind.
Keystone Driller Co., Beaver Falls, Penn.
Koehring Co., Milwaukee, Wis.—dragline, crane—see pages 38-39
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
Link-Belt Co., Chicago, Ill.—dragline cableway—see page 5 and back cover
Mansfield Eng. Co., Indianapolis, Ind.
The McMyler Interstate Co., Cleveland, O.—see page 189
The Marion Steam Shovel Co., Marion, O.—all kinds—see page 59
Monighan Machinery Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.—see insert between pages 2 and 3
Novo Engine Co., Lansing, Mich.
Owen Bucket Co., Cleveland, O.—see page 13
Orton & Steinbrenner, Chicago, Ill.—see page 53
The Osgood Co., Marion, O.—see page 54
Pawling & Harnischfeger Co., Milwaukee, Wis.
Sauerman Bros., Chicago, Ill.—see page 229
Schofield-Burkett Construction Co., Macon, Ga.—for stripping and loading
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
T. L. Smith Co., Milwaukee, Wis.
Thew Shovel Co., Lorain, O.—see page 180

EXPLOSIVES AND BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.—see page 45
General Explosives Co., Chicago, Ill.
The Giant Powder Co., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.—see page 208
Hercules Powder Co., Wilmington, Del.—see page 16
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Penn.

FANS

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Penn.
Clark Dust Collecting Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Garden City Fan Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
The Northern Blower Co., Cleveland, O.
The Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—exhaust—see pages 42-43
J. S. Schofield's Sons Co., Macon, Ga.—see pages 234-235
B. F. Sturtevant Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

FEEDERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The Automatic Furnace Co., Dayton, O.—coal
Barber-Greene Co., Aurora, Ill.—coal
C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bonnot Co., Canton, O.
C. G. Buchanan Co., Inc., New York, N. Y.—see pages 18-19
Dodge Mfg. Co., Mishawaka, Ind.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Good Roads Machinery Co., Inc., Kennett Square, Penn.—apron—see page 40
The Greenville Mfg. Co., Greenville, O.—automatic rotary
Gruendler Patent Crusher and Pulverizer Co., St. Louis, Mo.—see page 188
Wilbur G. Hudson Corp., New York, N. Y.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—disc, plunger, pendulum, roll, pan—see page 4
Link-Belt Co., Chicago, Ill.—apron—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Maddox Foundry & Machine Co., Archer, Fla.
The Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Robins Conveying Belt Co., New York, N. Y.—see page 14
F. L. Smidth & Co., New York, N. Y.—slurry, coal, cradle, dry, etc.—see pages 210-211
Smith Engineering Works, Milwaukee, Wis.—apron and plate—see page 239
Southwestern Eng. Co., Los Angeles, Calif.
Steacy-Schmidt Mfg. Co., New York, N. Y.
The Stearns Conveyor Co., Cleveland, O.—see page 250
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago. Ill.—see page 240
Williams Patent Crusher & Pulverizer Co., St. Louis Mo.—automatic—see pages 34-35

FEED WATER HEATERS

Bethlehem Shipbuilding Corp., Bethlehem, Penn.
The Brownell Co., Dayton, O.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Southwestern Eng. Co., Los Angeles, Calif.
The Superheater Co., New York, N. Y.
Worthing Pump and Machinery Corp., New York, N. Y.

FEED WATER REGULATORS

Co-operative Utilities Co., Philadelphia, Penn.
S-C Regulator Co., Fostoria, O.

FILTER CLOTH

American Wire Fabrics Corp., New York, N. Y.
Filter Fabrics Co., Salt Lake City, Utah
Ludlow-Saylor Wire Co., St. Louis, Mo.
Newark Wire Cloth Co., Newark, N. J.—see page 249
Wickwire, Spencer Steel Corp., New York, N. Y.

FILTERATION SYSTEMS—For Oil

S. F. Bowser & Co., Fort Wayne, Ind.

FIRE APPARATUS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—underwriters pumps—see page 179
Federal Electric Co., Chicago, Ill.—alarms
Foamite Childs Corporation, Utica, N. Y.
Howe Fire Apparatus Co., Anderson, Ind.
International Motor Co., New York, N. Y.
Mine Safety Appliances Co., Pittsburgh, Penn.
Safety First Supply Co., Pittsburgh. Penn.

FIRE CLAY
(See Refractories)

FORGES

Armstrong Mfg. Co., Waterloo, Ia.—see page 44
C. C. Bradley and Sons, Syracuse, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Penn.
Denver Rock Drill Mfg. Co., Denver, Colo.—oil, for drill steel—see page 64
Hauck Manufacturing Co., Brooklyn, N. Y.
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—see page 249
Ingersoll-Rand Co., New York, N. Y.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Newhall Chain Forge & Iron Co., New York, N. Y.
Philadelphia Steel & Iron Co., Philadelphia, Penn.
W. S. Tyler Co., Cleveland, O.—see page 257

FORGING

The Midvale Co., Philadelphia, Penn.—see page 48
Mackintosh-Hemphill Co., Pittsburgh, Penn.—see page 247
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257

FIRE BRICK

Ashland Fire Brick Co., Ashland, Ky.
Basic Products Co., St. Louis, Mo.
Betson Plastic Fire Brick Co., Rome, N. Y.
Chicago Fire Brick Co., Chicago, Ill.
Chicago Retort & Fire Brick Co., Chicago, Ill.
Eastern Clay Goods Co., Boston, Mass.
Foote Mineral Co., Inc., Philadelphia, Penn.
A. P. Green Fire Brick Co., Mexico, Mo.
Laclede-Christy Co., St. Louis, Mo.
Harbison-Walker Refractories Co., Pittsburgh, Penn.—see page 51
Robinson Clay Product Co., New York, N. Y.
Thomas Moulding Brick Co., Chicago, Ill.
Walsh Fire Clay Products Co., St. Louis, Mo.

FROGS AND SWITCHES

American Manganese Steel Co., Chicago Heights. Ill.—see page 209
Bethlehem Steel Co., Betlehem, Penn.
Buda Co., Harvey, Ill.
Central Frog & Switch Co., Cincinnati, O.—see page 27
Cincinnati Frog & Switch Co., Cincinnati, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Morrison & Risman, Buffalo, N. Y.
Weir Frog Co., Cincinnati, O.

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FUEL OIL
Standard Oil Co. of Indiana, Chicago, Ill.
Tidewater Oil Co., New York, N. Y.

FUEL OIL SYSTEMS
Bethlehem Ship Building Corp., Bethlehem, Penn.
Columbia Steel Tank Co., Kansas City, Mo.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Grindle Fuel Equipment Co., Harvey, Ill.
Smokeless Oil Burner Co., Bucyrus, O.—see page 254

FURNACES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Gas Furnace Co., Elizabeth, N. J.
The Automatic Furnace Co., Dayton, O.
Chapman-Stein Furnace Co., Mt. Vernon, O.
Eimer & Amend, New York, N. Y.—electric
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
General Chemical Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Ingersoll-Rand Co., New York, N. Y.
K-B Pulverizer Corp., New York, N. Y.—powdered coal—see page 254
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo—see pages 20-21
Reeves Bros. Co., Alliance, O.—see page 228
Sullivan Machinery Co., Chicago, Ill.—drill steel only—see page 216
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.
Worthington Pump and Machinery Corp., New York, N. Y.

FURNACES—Laboratory
E. H. Sargent & Co., Chicago, Ill.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

FUSE—Blasting
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.—see page 45
Ensign-Bickford Co., Simsbury, Conn.—Cordeau-Bickford detonating—see page 200
The Giant Powder Co., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, Ohio—see page 208
Hercules Powder Co., Wilmington, Del.—Cordeau-Bickford detonating—see page 16
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Penn.

FUSES—Electrical
Bussmann Mfg. Co., St. Louis, Mo.
Chicago Fuse Mfg. Co., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Penn.
Economy Fuse & Mfg. Co., Chicago, Ill.
Federal Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric and Mfg. Co., E. Pittsburgh, Penn.

FUSES—Renewable
Economy Fuse Mfg. Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

GASKETS
Buffalo Weaving & Belting Co. Buffalo, N. Y.
The Booth Felt Co., Inc., Brooklyn, N. Y.
Colonial Supply Co., Pittsburgh, Penn.
Crane Co., Chicago, Ill.
B. F. Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
Jenkins Bros., New York, N. Y.
Johns-Manville, Inc., New York, N. Y.
McCord Radiator Mfg. Co., Inc., Detroit, Mich.
New York Belting & Packing Co., New York—see page 181
Quaker City Rubber Co., Philadelphia, Penn.

GATES—Bin
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Austin Mfg. Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
The C. O. Bartlett and Snow Co., Cleveland, O.
Beaumont Mfg. Co., Philadelphia, Penn.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Conveyors Corporation of America, Chicago, Ill.
The C. S. Card Iron Works Co., Denver, Colo.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Good Roads Machinery Co., Inc., Kennett Square, Penn.—chutes—see page 40
Greenville Mfg. Co., Greenville, O.
C. W. Hunt & Co., Staten Island, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
McGann Mfg. Co., York, Penn.—see page 29
Palmer-Bee Co., Detroit, Mich.—see page 217
Reeves Bros. Co., Alliance, O.—see page 228
Robins Conveying Belt Co., New York, N. Y.—see page 14
Rogers Foundry & Machine Co., Joplin, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
James B. Seaverns Co., Chicago, Ill.—see inside back cover
Smith Engineering Works, Milwaukee, Wis.—see page 239
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 257
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

GAS ENGINES—See Engines

GAS PRODUCERS
The Chapman Engineering Co., Mt. Vernon, O.
Duff Patents Co., Inc., Pittsburgh, Penn.
Gas Producer & Engineering Corp. of New Jersey, Philadelphia, Penn.
McGann Manufacturing Co., Inc., York, Penn.—see page 29
Morgan Construction Co., Worcester, Mass.—see page 238
The Otto Engine Works, Philadelphia, Penn.
Wellman-Seaver-Morgan Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Penn.—see page 238

GAUGES
The Brown Instrument Co., Philadelphia, Pa.—pressure, vacuum and draft
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Taylor Instrument Co., Rochester, N. Y.

GLASS SAND EQUIPMENT
American Process Co., New York, N. Y.—see inside back cover
Dorr Co., New York, N. Y.
Kennedy-Van Saun Engineering & Machinery Co., New York, N. Y.—see page 4
Lewistown Foundry & Machine Co., Lewistown, Penn.—see pages 214-215
Louisville Drying Machy Co., Louisville, Ky.
Stevenson Co., Wellsville, O.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

GEARS
Albaugh-Dover Mfg. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Bethlehem Steel Co., Betlehem, Penn.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—cast
The Cleveland Worm & Gear Co., Cleveland, O.—worm
De Laval Steam Turbine Co., Trenton, N. J.
Dodge Sales and Engineering Co., Mishawaka, Ind.—conveying and friction
The Falk Corp., Milwaukee, Wis.
Fawcus Machine Co., Pittsburgh, Penn.
Farrell Foundry & Mach. Co., Buffalo, N. Y.—herringbone and helical
Foote Bros. Gear & Machine Co., Chicago, Ill.—spur, helical and worm—see page 15
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
William Ganschow Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Inland Engineering Co., Chicago, Ill.
D. O. James Mfg. Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Morgan Eng. Co., Alliance, O.—see page 239
The Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Moore Steam Turbine Co., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y.—silent chain, spring—see page 10
W. F. Mosser & Son, Allentown, Penn.
Palmer-Bee Co., Detroit, Mich.—see page 217
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Philadelphia Gear Works, Philadelphia, Penn.
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Penn.
A. Plamondon Mfg. Co., Chicago, Ill.
The Poole Engineering & Machine Co., Baltimore, Md.—see page 256
Reeves Bros. Co., Alliance, O.—see page 228
Robins Conveying Belt Co., New York, N. Y.—see page 14
Stroh Steel-Hardening Process Co., Pittsburgh, Penn.
Stephens-Adamson Mfg. Co., Aurora, Ill.—cast and cut—see page 194
Superior Iron Works Co., Superior, Wis.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel—see page 11
Terry Steam Turbine Co., Hartford, Conn.
Tool Steel Gear & Pinion Co., Cincinnati, O.—spur, bevel and tooth.
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Westinghouse Electric and Mfg. Co., East Pittsburgh, Penn.

GEAR TRANSFORMERS
(See Speed Transformers)

GENERATORS—ELECTRICAL
See Electric Motors

GRATES
Arnold & Weigel, Woodville, O.—see page 26
The Automatic Furnace Co., Dayton, O.—shaking and dumping
Brownell Co., Dayton, O.
Canton Grate Co., Canton, O.
Combustion Engineering Corp., New York, N. Y.
Gehret Bros., Inc., Bridgeport, Penn.
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Kramer Bros. Foundry Co., Dayton, O.—shaking and dumping.—see page 244
Saxe & Heald, Chicago, Ill.
Schaffer Engineering Co., Pittsburgh, Penn.—see page 28
Sanford-Riley Stoker Co., Worcester, Mass.
Steacy-Schmidt Mfg. Co., New York, N. Y.

GREASE
(See Lubricants)

GRIZZLIES
Allis-Chambers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
C. O. Bartlett & Snow Co., Cleveland, O.
C. S. Card Iron Works Co., Denver, Colo.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—see page 198
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Wilbur G. Hudson Corp., New York, N. Y.
Jeffery Mfg. Co., Columbus, O.—see pages 226-227

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Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Robins Conveying Belt Co., New York, N. Y.—cataract—see page 14
Rogers Foundry & Machine Co., Joplin, Mo.
Smith Engineering Works, Milwaukee, Wis.—see page 239
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
W. Toepfer & Sons Co., Milwaukee. Wis.—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn. see pages 222-223
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Western Wheeled Scraper Co., Aurora, Ill.—see page 203
Wickwire Spencer Steel Corp., New York, N. Y.
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—see pages 34-35

GUARDS—Machinery

Buffalo Wire Works Co., Buffalo, N. Y.
Hendrick Manufacturing Co., Carbondale, Penn.—see page 260

GYPSUM AND GYPSUM PLASTER PLANTS

Butterworth & Lowe, Grand Rapids, Mich.—see page 250
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Richard K. Meade & Co., Baltimore, Md.

HAIR PICKERS

J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan—see page 251

HANGERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Chain Belt Co., Milwaukee, Wis.
R. & J. Dick Co., Inc., Passaic, N. J.—shaft
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Clutch Mach. & Fdry. Co., Cleveland, O.—see page 249
Jeffery Mfg. Co., Columbus, O.—see pages 226-227
W. A. Jones Foundry & Machine Co., Chicago, Ill.—shaft
Link-Belt Co., Chicago, Ill.—electric—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Palmer-Bee Co., Detroit, Mich.—see page 217
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
T. B. Wood's Sons Co., Chambersburg, Penn.

HEATERS—See Blow Torches

The Brownell Co., Dayton, O.
General Electric Co., Schenectady, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.

HEATING APPARATUS—Fan Systems

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186
Coe Mfg. Co., Painesville, O.—see pages 230-231

HOISTS—Steam, Gasoline and Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The American Cement Machine Co., Inc., Keokuk, Ia.
American Hoist & Derrick Co., St. Paul, Minn.—see page 251
American Mfg. & Eng. Co., Kalamazoo, Mich.—gasoline—see page 242
Austin Manufacturing Co., Chicago, Ill.—see page 247
Austin Western Road Machinery Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
Beach Mfg. Co., Charlotte, Mich.—double-drum
R. H. Beaumont Co., Philadelphia, Penn.—skip
Bedford Foundry & Machine Co., Bedford, Ind.
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—steam, gasoline, electric and belt—see page 199
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Chicago Pneumatic Tool Co., New York, N. Y.—air
Clyde Iron Works, Duluth, Minn.
Columbia Steel Tank Works, Kansas City, Mo.—truck
Conveyors Corp. of America, Chicago, Ill.
Denver Rock Drill Mfg. Co., Denver, Colo.—pneumatic—see page 64
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
Ellicott Machine Corp., Baltimore, Md.
English Bros. Steel & Machy. Co., Kansas City, Mo.
Erie Clutch & Pulley Co., Erie, Penn.
The Erie Hoist Co., Erie, Penn.
Exeter Machine Works, Inc., West Pittston, Penn.
Fairbanks, Morse & Co., Chicago, Ill.
S. Flory Mfg. Co., Bangor, Penn.—see page 257
General Electric Co., Schenectady, N. Y.
The Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machinery Co., Kennett Square, Penn.—see page 40
L. P. Green, Chicago, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 188
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
The Hayward Co., New York, N. Y.
The Heil Co., Milwaukee, Wis.—truck
Joshua Hendy Iron Works, San Francisco, Calif.
C. W. Hunt & Co., Inc., W., Staten Island, N. Y.
Ideal Engine Co., Lansing, Mich.—gas
Ingersoll-Rand Co., New York, N. Y.—air
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., Columbus, O.—skip—see pages 226-227
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Lake Shore Engine Works, Marquette, Mich.
Lambert Hoisting Engine Co., Newark, N. J.
Lansing Motor & Pump Co., Lansing, Mich.—drum, dragline
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
Link-Belt Co., Chicago, Ill.—electric—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—plain, geared and friction
Manning, Maxwell & Moore, Inc., New York, N. Y.
The Marion Steam Shovel Co., Marion, O.—see page 59
Maris Brothers, Inc., Philadelphia, Penn.—electric
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—friction and electric—see page 250
The McMyler Interstate Co., Cleveland, O.—see page 189
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mining Machine Co., Mountville, Penn.—motor driven
Motorbloc Corporation, Summerdale, Philadelphia, Penn.—chain driven
J. S. Mundy Hoisting Engine Co., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246
Nordberg Mfg. Co., Milwaukee, Wis.
Northern Engineering Works, Detroit, Mich.—monorail, grab bucket, electric and air
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Machinery Co., Columbia, Penn.—drum, reversible and non-reversible, gasoline, electric or belt drive
Orr & Sembower, Reading, Penn.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Ottumwa Iron Works, Ottumwa, Ia.—electric and steam—see page 242
Palmer-Bee Co., Detroit, Mich.—see page 217
Pawling & Harnischfeger Co., Milwaukee, Wis.
The Pneumelectric Corp., Syracuse, N. Y.
Jos. T. Ryerson & Son, Chicago, Ill.
Schramm, Inc., West Chester, Penn.—compressor
Smith Engineering Works, Milwaukee, Wis.—see page 239
Standard Steel Works, North Kansas City, Mo.—truck
Sullivan Machinery Co., Chicago, Ill.—steam and electric, single and double drum—see page 216
Thomas Elevator Co., Chicago, Ill.—band and cone friction—see page 17
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Weller Mfg. Co., Chicago, Ill.—see page 240
Wellman-Seaver-Morgan Co., Cleveland, O.
Wood-Detroit Hydraulic Hoist Co., Detroit, Mich.
Wright Mfg. Co., Lisbon, O.—high speed

HOISTS—Air

Curtis Pneumatic Machinery Co., St. Louis, Mo.—see page 257
Hanna Eng. Works, Chicago, Ill.
Heil Co., Milwaukee, Wis.
Sullivan Machinery Co., Chicago, Ill.—see page 216

HOISTS—Hand

Erie Hoist Co., Erie, Pa.
Motorbloc Corp., Philadelphia, Penn.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Wright Mfg. Co., Lisbon, O.
Yale & Towne Mfg. Co., Stanford, Conn.

HOOKS

The Columbus-McKinnon Chain Co., Columbus, O.
Macwhyte Co., Kenosha, Wis.
Newhall Chain Forge & Iron Co., New York, N. Y.
United States Chain & Forging Co., Pittsburgh, Penn.
The Wellman-Seaver-Morgan Co., Cleveland, O.

HOPPERS AND SPOUTS

Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Atlas Engineering Co., Milwaukee, Wis.
Biehl Iron Works, Reading Penn.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Dings Magnetic Separator Co., Milwaukee, Wis.—spouts—see inside front cover
The Galion Iron Works & Mfg. Co., Galion, O.
Gehret Bros., Bridgeport, Penn.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—see page 188
The Greenville Mfg. Co., Greenville, O.
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Wilbur G. Hudson Corp., New York, N. Y.
Jackson & Church Co., Saginaw, Mich.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.—hoppers
Magnetic Mfg. Co., Milwaukee, Wis.—magnetic spouts—see page 257
McGann Mfg. Co., York, Penn.—see page 29
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246
The Reeves Bros. Co., Alliance, O.—hoppers—see page 228
Rogers Foundry & Machine Co., Joplin, Mo.
Palmer-Bee Co., Detroit, Mich.—see page 217
James B. Seaverns, Chicago, Ill.—steel—see inside back cover
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Sturtevant Mill Co., Boston, Mass.—see page 257
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Union Enginereing Co., Cleveland, O.
Webb City & Carterville Fdry. & Mach. Co., Webb City, Mo.
Weller Mfg. Co., Chicago, Ill.—see page 240
The Youngstown Boiler & Tank Co., Youngstown, O.

HOSE—Water, Steam, Pneumatic, Air Drill

The Alexander Milburn Co., Baltimore, Md.—welding
The American Metal Hose Co., Waterbury, Conn.—flexible metal
Badger Belt & Rubber Corp., Milwaukee, Wis.
Boston Woven Hose & Rubber Co., Boston, Mass.—see page 6
Chicago Pneumatic Tool Co., New York, N. Y.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.—see page 240
The Cleveland Rock Drill Co., Cleveland, O.

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Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Trenton, N. J. .....
B. F. Goodrich Rubber Co., Akron, O.—all kinds
The Goodyear Tire & Rubber Co., Akron, O.
Hardscog Wonder Drill Co., Ottumwa, Ia.
Ingersoll-Rand Co., New York, N. Y.
The Manhattan Rubber Mfg. Co., Chicago, Ill.—all kinds
The McIlroy Belting & Hose Co., Hammond, Ind.
Mulconroy Co., Philadelphia, Penn.—metallic and all kinds
New York Belting & Packing Co., New York, N. Y.—see page 181
New York Rubber Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Penn.
The Republic Rubber Co., Youngstown, O.—all kinds
Robins Conveying Belt Co., New York, N. Y.—see page 14
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.
W. H. Salisbury & Co., Inc., Chicago, Ill.
Schramm, Inc., West Chester, Penn.—air
Sullivan Machy. Co., Chicago, Ill.—see page 216
Thermoid Rubber Co., Trenton, N. J.—all kinds
United States Rubber Co., New York, N. Y.
United States Rubber Co., Akron, O.
Weller Mfg. Co., Chicago, Ill.—see page 240

HOSE—Rubber

Boston Woven Hose & Rubber Co., Boston, Mass.—see page 6
Cincinnati Rubber Mfg. Co., Cincinnati, O.—see page 240
Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Trenton, N. J.
B. F. Goodrich ubber Co., Akron, O.
The Goodyear Tire & Rubber Co., Akron, O.
Mulconroy Co., Philadelphia, Penn.
New York Belting & Packing Co., New York, N. Y.—see page 181
Quaker City Rubber Co., Philadelphia, Penn.
Schramm, Inc., West Chester, Penn.
Steacy-Schmidt Mfg. Co., New York, N. Y.
United States Rubber Co., New York, N. Y.

HOUSES—Portable

Littleford Bros., Cincinnati, O.
Wisconsin Bridge & Iron Co., N. Milwaukee, Wis.

HYDRATING EQUIPMENT

Arnold & Weigel, Woodville, O.—see page 26
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Blaw-Knox Co., Pittsburgh, Penn.
Jackson & Church Co., Saginaw, Mich.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
The Kritzer Co., Chicago, Ill.—see inside back cover
McGann Mfg. Co., Inc., York, Penn.—see page 29
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell Co., Duluth, Minn.—see pages 30-31
Schaffer Eng. Co., Pittsburgh, Penn.—see page 28
Steacy-Schmidt Mfg. Co., New York, N. Y.
W. Topefer & Sons Co., Milwaukee, Wis.—see page 245
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233

HYGROMETERS—Indicating and Recording

Brown Instrument Co., Philadelphia, Penn.

INDICATING AND RECORDING INSTRUMENTS—Pyrometers

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Penn.
Cleveland Instrument Co., Cleveland, O.
Foxboro Co., Inc., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Penn.
E. H. Sargent Co., Chicago, Ill.
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Penn.
Wilson-Maulen Co., New York, N. Y.

INSULATION—Heat

Armstrong Cork and Insulation Co., Pittsburgh, Penn.
Celite Products Co., Chicago, Ill.—cement kiln, boiler, lime kiln, high temperature cements
Johns-Manville, Inc., New York, N. Y.
Quigley Furnace Specialties Co., New York, N. Y.

JACKS—All Kinds

Buda Co., Harvey, Ill.—ratchet, screen
Duff Manufacturing Co., Pittsburgh, Penn.
Templeton-Kenley Co., Chicago, Ill.

KETTLES—Calcining

Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Butterworth & Lowe, Grand Rapids, Mich.—see page 250
J. B. Ehrsam & Sons Co., Enterprise, Kan.—see page 251
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Reeves Bros. Co., Alliance, O.—see page 228
Standard Steel Works, North Kansas City, Mo.

KILNS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Process Co., New York, N. Y.—see inside back cover
Arnold & Weigel, Woodville, O.—shaft—see page 26
C. O. Bartlett & Snow Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Penn.
The Bonnot Co., Canton, O.—rotary
Chicago Bridge & Iron Works, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Penn.
Duff Patents Co., Inc., Pittsburgh, Penn.—rotary and shaft
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Joshua Hendy Iron Works, San Francisco, Calif.
Hendrick Mfg. Co., Carbondale, Penn.—lime—see page 260
The Improved Equipment Co., New York, N. Y.—vertical type, Doherty-Eldred process
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Louisville Drying Machy. Co., Louisville, Ky.
Manitowoc Ship Building Corp., Manitowoc, Wis.—see page 50
McGann Mfg. Co., Inc., York, Penn.—rotary and vertical—see page 29
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.—shaft—see pages 30-31
W. F. Mosser & Son, Allentown, Penn.—rotary
The Reeves Bros. Co., Alliance, O.—rotary, cement and lime—see page 228
Ruggles-Coles Engineering Co., New York, N. Y.—see page 187
Schaffer Engineering Co., Pittsburgh, Penn.—see page 28
F. L. Smidth & Co., New York, N. Y.—rotary—see pages 210-211
Steacy-Schmidt Mfg. Co., New York, N. Y.—shaft
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Penn.—rotary—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—rotary and shaft—see page 233
Weller Mfg. Co., Chicago, Ill.—see page 240

LABORATORY EQUIPMENT

Braun Corp., Los Angeles, Calif.
Central Scientific Materials Co., Chicago, Ill.
Eimer & Amend, New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Riehle Testing Machine Co., Philadelphia, Penn.
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 257
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.

LACING—Belt
(See Belt Lacing)

LIGHTS—Portable Acetylene

Carbic Mfg. Co., Duluth, Minn.
The Macleod Co., Cincinnati, O.
Alexander Milburn Co., Baltimore, Md.

LIME HANDLING EQUIPMENT

J. R. Alsing Engineering Co., New York, N. Y.
Arnold & Weigel, Woodville, O.—see page 26
C. O. Bartlett & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
George Haiss Mfg. Co., New York, N. Y.
Wilbur G. Hudson Corp., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Kritzer Co., Chicago, Ill.—see inside back cover
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
H. Miscampbell, Duluth, Minn.—see pages 30-31
Schaffer Eng. Co., Pittsburgh, Penn.—see page 28
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Sturtevant Mill Co., Boston, Mass.—see page 257
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

LIME AND HYDRATING PLANTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Arnold & Weigel, Woodville, O.—see page 26
Bland Eng. Co., Minneapolis, Minn.
The Bonnot Co., Canton, O.
Blue Diamond Materials Co., 5034 Grand Central Terminal, New York, N. Y.—A. P. McCallie, General Agent—see page 205
Fuller-Lehigh Co., Fuller Engr. Div., Fullerton, Penn.—see page 212
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Komnick Machy. Co., Detroit, Mich.
Kritzer Co., Chicago, Ill.—see inside back cover
McGann Mfg. Co., Inc., York, Penn.—see page 29
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.—see pages 30-31
The Reeves Bros. Co., Alliance, O.—see page 228
Schaffer Engineering Co., Pittsburgh, Penn.—see page 28
Steacy-Schmidt Mfg. Co., New York, N. Y.
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233

LIME PACKERS

S. Howes Co., Inc., Silver Creek, N. Y.
Valve Bag Co. of America, Toledo, O.—see pages 8-9

LINE SHAFT EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
H. W. Caldwell & Sons Co., Chicago, Ill.—see page 37
Dodge Mfg. Co., Mishawaka, Ind.
Hill Clutch Mach. & Fdry. Co., Cleveland, O.—see page 249
Jones Fdry. & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 5 and inside back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Palmer-Bee Co., Detroit, Mich.—see page 217
Weller Mfg. Co., Chicago, Ill.—see page 240
T. B. Wood's Sons Co., Chambersburg, Penn.

LOADERS—Unloaders

Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp., Toledo, O.—wagon
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
Bay City Foundry & Machine Co., Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Burch Plow Works, Crestline, O.
The Byers Machine Co., Ravenna, O.—car and wagon—see page 199
H. W. Caldwell & Sons Co., Chicago, Ill.—see page 37
Chain Belt Co., Milwaukee, Wis.
Doolittle-Stephens, Ltd., Hagersville, Ont., Can.—see page 191
The Dust Recovering & Conveying Co., Cleveland, O.
Erie Steam Shovel Co., Erie, Penn.—see page 241
Fairmount Mining Machinery Co., Fairmont, W. Va.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
The Good Roads Machinery Co., Inc., Kennett Square, Penn.—see page 40
B. F. Goodrich Rubber Co., Akron, O.
The Geo. Haiss Mfg. Co., New York, N. Y.—all kinds
The Hamilton Mfg. Co., Columbus, O.
Hoar Shovel Co., Duluth, Minn.
Holly Pnuematic Systems, Inc., New York, N. Y.—pneumatic
Industrial Works, Bay City, Mich.—see page 55
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Komnick Machy. Co., Detroit, Mich.
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—all types—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manierre Engineering & Machinery Co., Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.—see page 59
The McMyler-Interstate Co., Cleveland, O.—see page 189
McKinney-Harrington Co., North Chicago, Ill.
Myers-Whaley Co., Knoxville, Tenn.
National Conveying Equipment Corp., Chicago, Ill.
Nordberg Mfg. Co., Milwaukee, Wis.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246
Orton & Steinbrenner Co., Chicago, Ill.—see page 53
The Osgood Co., Marion, O.—see page 54

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Ottumwa Box Car Loader Co., Ottumwa, Ia.—box car
Pawling & Harnischfeger Co., Milwaukee, Wis.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—see page 14
James B. Seaverns Co., Chicago, Ill.—see inside back cover
The Security Engineering Sales Co., Duluth, Minn.
T. L. Smith, Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Penn.—chain and bucket type
The Sunbury Mfg. Co., Sunbury, O.
Thew Shovel Co., Lorain, O.—see page 180
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

LOCOMOTIVES—Compressed Air
H. K. Porter Co., Pittsburgh, Penn.—see page 246

LOCOMOTIVES—Electric and Storage Battery
American Locomotive Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Baldwin Locomotive Works, Philadelphia, Penn.
M. K. Frank, Pittsburgh, Penn.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Hunt, C. W. Co., Staten Island, N. Y.
The Ironton Engine Co., Ironton, O.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Mancha Storage Battery Locomotive Co., St. Louis, Mo.
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Westinghouse Electric & Mfg. Co., East Pittsburgh, Penn.
Geo. D. Whitcomb, Rochelle, Ill.—see page 196

LOCOMOTIVES—Gasoline
Adamson Motor Co., Birmingham, Ala.—see page 36
American Locomotive Co., New York, N. Y.
The Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Austin Machinery Corp., Toledo, O.
Baldwin Locomotive Works, Philadelphia, Penn.
Brookville Truck & Tractor Co., Brookville, Penn.—see page 236
Davenport Locomotive Works, Davenport, Ia.—see page 253
Easton Car & Construction Co., Easton, Penn.—see page 204
The Fate-Root-Heath Co., Plymouth, O.—Plymouth—see front cover
Industrial Equipment Co., Minster, O.
Koppel Industrial Car & Equipment Co., Koppel, Penn.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Plymouth Locomotive Works, Plymouth, O.—see front cover
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Geo. D. Whitcomb Co., Rochelle, Ill.—see page 196

LOCOMOTIVES—Steam
American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Penn.
Birmingham Rail & Locomotive Co., Birmingham, Ala.
Davenport Locomotive Works, Davenport, Ia.—see page 253
Heisler Locomotive Works, Erie, Penn.
Lima Locomotive Works, Lima, O.—see page 241
H. K. Porter Co., Pittsburgh, Penn.
Vulcan Iron Works, Wilkes-Barre Penn.—see page 233

LOCOMOTIVE TIRES
The Midvale Co., Philadelphia, Penn.—see page 48

LOG WASHERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic—see inside front cover
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Lewistown Fdy. & Machine Co., Lewistown, Penn.—see pages 214-215
Magnetic Mfg. Co., Milwaukee, Wis.—see page 257
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—see page 250
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.

LUBRICANTS—Oils and Greases
Adam Cook's Sons Co., New York, N. Y.
Colonial Supply Co., Pittsburgh, Penn.
Dearborn Chemical Co., Chicago, Ill.
Fiske Bros. Refining Co., New York, N. Y.
Indian Refining Co., New York, N. Y.
Ironsides Co., Columbus, O.—wire rope and gear
Keystone Lubricating Co., Philadelphia, Penn.—see page 47
A. Leschen & Sons Co., St. Louis, Mo.—wire rope—see page 288
Lunkenheimer Co., Cincinnati, O.
Ohio Grease Co., Loudonville, O.
Standard Oil Co. of Indiana, Chicago, Ill.
The Texas Company, New York, N. Y.
Tidewater Oil Co., New York, N. Y.
Vacuum Oil Co., New York, N. Y.

LUBRICATING SYSTEMS
S. F. Bowser & Co., Inc., Ft. Wayne, Ind.—automatic
Gilbert & Barker Mfg. Co., Springfield, Mass.
Keystone Lubricating Co., Philadelphia, Penn.—see page 47
McCord Radiator & Mfg. Co., Detroit, Mich.
Ohio Grease Co., Loudonville, O.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Sanford-Day Iron Works, Knoxville, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

LUBRICATORS
S. F. Bowser & Co., Inc., Ft. Wayne, Ind.
Keystone Lubricating Co., Philadelphia, Penn.—see page 47
The Ohio Grease Co., Loudonville, O.

MACHINE SHOP EQUIPMENT
The Black & Decker Mfg. Co., Baltimore, Md.
Champion Blower & Forge Co., Lancaster, Penn.
Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Manning, Maxwell & Moore, Inc., New York, N. Y.
Moore & Moore, Reading, Penn.
Sullivan Machinery Co., Chicago, Ill.—see page 216

MAGAZINES—Storage, Portable
Littleford Bros., Cincinnati, O.

MAGNETIC DEVICES
Pulleys, Separators, Drums, Concentrators, Safety Magnets, Magnetic Spouts, Special Magnets
C. G. Buchanan Co., New York, N. Y.—see pages 18-19
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—clutches, pulleys, starters, etc.
Dings Magnetic Separator Co., Milwaukee, Wis.—see inside front cover
Electric Controller & Mfg. Co., Cleveland, O.
S. Howes Co., Silver Creek, N. Y.
Magnetic Mfg. Co., Milwaukee, Wis.—see page 257
J. W. Paxson Co., Philadelphia, Pa.—see page 253

MANGANESE STEEL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Bethlehem Steel Co., Bethlehem, Penn.
Electric Manganese Steel Co., Reading, Penn.—see page 213
Hadfield-Penfield Steel Co., Byrucus, O.—see pages 182-183
Inland Engineering Co., Chicago, Ill.
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Moore & Moore, Reading, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—castings—see page 11

MANGANESE STEEL PLATES, BARS, ETC. (See Manganese Steel)
Mangenese Steel Forge Co., Philadelphia, Penn.—see page 257

MAN LIFTS
The Barnard Machinery Co., Enterprise, Kans.
Bland Engineering Co., Minneapolis, Minn.

MANILA ROPE
Armstrong Mfg. Co., Waterloo, Ia.—see page 44
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Colonial Supply Co., Pittsburgh, Penn.
Columbian Rope Co., Auburn, N. Y.
O. H. Davidson Equipment Co., Denver, Colo.
Filter Fabrics Co., Salt Lake City, Utah
C. W. Hunt & Co., Inc., Staten Island, N. Y.
Hooven-Allison Co., Xenia, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Plymouth Cordage Co., New Plymouth, Mass.
Rugg Co., The E. T., Newark, O.—see page 255
Upson-Walton Co., Cleevland, O.
Waterbury Co., New York, N. Y.

MASKS
Electric Arc Cutting & Welding Co., Newark, N. J.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.

MEASURING DEVICES
C. W. Hunt Co., Inc., W. New Brighton, N. Y.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—see page 246

MECHANICAL DRAFT APPARATUS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186

MECHANICAL RUBBER GOODS
Badger Belt & Rubber Corp., Milwaukee, Wis.
Buffalo Weaving & Belting Co., Buffalo, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass.—see page 6
Cincinnati Rubber Mfg. Co., Cincinnati, O.—see page 240
Doolittle-Stephens, Ltd., Hogersville, Ont., Can.—see page 191
Empire Tire & Rubber Co. of N. J., Trenton, N. J.
B. F. Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
New York Belting & Packing Co., New York, N. Y.—see page 181
Quaker City Rubber Co., Philadelphia, Penn.
U. S. Rubber Co., New York, N. Y.

METERS
(Temperature, Pressure, Speed, CO_2 and Draft)
Bailey Meter Co., Chicago, Ill.
Brown Instrument Co., Philadelphia, Penn.
Taylor Instrument Co., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.

MILLS—Grinding
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 129
J. R. Alsing Engineering Co., New York, N. Y.—ball, tube, pebble
American Pulverizer Co., St. Louis, Mo.
Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Pa.—see page 52
Brainard Pulverizer Co., Chicago, Ill.
Braun Corp., Los Angeles, Calif.
Butterworth & Lowe, Grand Rapids, Mich.—Buhr stone—see page 250
Colorado Iron Works, Denver, Colo.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—gypsum—see page 251
Fuller-Lehigh Co., Fullerton, Pa.—ball, tube—see page 212
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—see page 188
Hardinge Co., New York, N. Y.—ball, conical—see page 3
Jackson & Church Co., Saginaw, Mich.
Joshua Hendy Iron Works, San Francisco, Calif.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Komnick Machy. Co., Detroit, Mich.
K-B Pulverizer Co., Inc., New York, N. Y.—hammer—see page 254
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Kent Mill Co., Brooklyn, N. Y.—see page 245
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Munson Mill Machinery Co., Inc., Utica, N. Y.—Buhr stone—see page 253
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 42-43
The Reeves Bros. Co., Alliance, O.—see page 228
Southwestern Eng. Co., Los Angeles, Calif.
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 257
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223

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Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.
O. B. Wise Pulverizer Co., Knoxville, Tenn.

MIXERS

The American Cement Machine Co., Inc., Keokuk, Ia.—concrete
Atlas Eng. Co., Milwaukee, Wis.
Beach Mfg. Co., Charlotte, Mich.
Blystone Mfg. Co., Cambridge Springs, Penn.—concrete
Buttress Plaster Board Machinery Co., Los Angeles, Calif.—gypsum
Chain Belt Co., Milwaukee, Wis.—concrete
Concrete Equipment Co., Holland, Mich.—concrete
Dorr Co., New York, N. Y.—slurry
W. E. Dunn Manufacturing Co., Holland, Mich.—concrete
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Helm Brick Machine Co., Cadillac, Mich.—concrete
Ideal Concrete Machinery Co., Cincinnati, O.—concrete—see page 255
Koehring Co., Milwaukee, Wis.—see pages 38-39
Komnick Machy. Co., Detroit, Mich.
Lakewood Engineering Co., Cleveland, O.—concrete
Manning, Maxwell & Moore, Inc., New York, N. Y.
H. Miscampbell, Duluth, Minn.—see pages 30-31
Orr & Sembower, Inc., Reading, Penn.
T. L. Smith Co., Milwaukee, Wis.—concrete
Sturtevant Mill Co., Boston, Mass.—see page 257
Union Engineering Co., Cleveland, O.—concrete

MIXING PANS

The Bonnot Co., Canton, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Jackson-Church Co., Saginaw, Mich.
Komnick Machy. Co., Detroit, Mich.
Stevenson Co., Wellsville, O.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

MOLDS—Catch Basin and Silo

Wert Mfg. Co., Chicago, Ill.

MORTAR COLORS

C. K. Williams & Co., Easton, Penn.—see page 256

MORTAR MIXING PLANTS

Blue Diamond Materials Co., 5034 Grand Central Terminal, New York, N. Y.—A. P. McCallie, General Agent—see page 205

MOTORS AND GENERATORS
(See Electric Motors, etc.)

MOTOR TRUCKS

Acme Motor Truck Co., Cadillac, Mich.
O. Armleder Co., Cincinnati, O.
Autocar Co., Ardmore, Penn.
Clark Tructractor Co., Chicago, Ill.
Columbia Motor Truck Co., Pontiac, Mich.
Commercial Truck Co., Philadelphia, Penn.
Diamond T Motor Car Co., Chicago, Ill.
Federal Motor Truck Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.—see page 57
Four-Wheel-Drive Auto Co., Clintonville, Wis.—3 T. with power dump body
The Garford Motor Truck Co., Lima, O.
General Motors Truck Co., Pontiac, Mich.
Gramm-Bernstein Motor Truck Co., Lima, O.
International Motor Co., New York, N. Y.
Lee Trailer & Body Co., Chicago, Ill.—trailers
Lewis-Hall Motors Corp., Detroit, Mich.
The Nash Motors Co., Kenosha, Wis.
The Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Truck Sales Corp., Alma, Mich.
Service Motors, Inc., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Titian Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
The White Co., Cleveland, O.
U. S. Motor Truck Co., Covington, Ky.

NOZZLES—Hose

Dixon Valve & Coupling Co., Philadelphia, Penn.
Knox Mfg. Co., Philadelphia, Penn.—see page 201

NIPPLES

Dixon Valve & Coupling Co., Philadelphia, Penn.
Knox Mfg. Co., Philadelphia, Penn.—see page 201

OIL
(See Lubricants)

OIL BURNERS

Aeroil Burner Co., Inc., Union Hill, N. J.
Alexander-Milburn Co., Baltimore, Md.
Babcock & Wilcox Co., New York, N. Y.
W. N. Best Furnace & Burner Corp., New York, N. Y.
Bethlehem Ship Building Corp., Bethlehem, Penn.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hauck Mfg. Co., Brooklyn, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
The Macleod Co., Cincinnati, O.
W. S. Ray Mfg. Co., San Francisco, Calif.
Smokeless Oil Burner Co., Bucyrus, O.—see page 254
Tate-Jones & Co., Pittsburgh, Penn.

OIL ENGINES
(See Engines)

PACKINGS

The Booth Felt Co., Inc., Brooklyn, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass.—see page 6
Buffalo Weaving & Belting Co., Buffalo, N. Y.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.—see page 240
Colonial Supply Co., Pittsburgh, Penn.
Crane Co., Chicago, Ill.
Empire Tire & Rubber Corp., Trenton, N. J.—rubber
The Garlock Packing Co., Palmyra, N. Y.
B. F. Goodrich Rubber Co., Akron, O.—all kinds
The Goodyear Tire & Rubber Co., Inc., Akron, O.
The Graton & Knight Mfg. Co., Worcester, Mass.—leather
Greene, Tweed & Co., New York, N. Y.
Jenkins Bros., New York
Johns-Manville, Inc., New York, N. Y.—asbestos
The Manhattan Rubber Mfg. Co., Chicago, Ill.—rubber
Manning, Maxwell & Moore, Inc., New York, N. Y.
N. Y. Belting & Packing Co., New York, N. Y.—see page 181
New York Rubber Co., New York, N. Y.—all kinds
Quaker City Rubber Co., Philadelphia, Penn.
The Republic Rubber Co., Youngstown, O.—sheet
W. H. Salisbury & Co., Inc., Chicago, Ill.
Thermoid Rubber Co., Trenton, N. J.—asbestos sheet
United States Rubber Co., New York, N. Y.

PACKING MACHINERY

Bates Valve Bag Co., Chicago, Ill.
J. B. Ehrsam & Sons Co., Enterprise, Kans.—see page 251
S. Howes Co., Inc., Silver Creek, N. Y.
H. Miscampbell, Duluth, Minn.—see pages 30-31
Modern Valve Bag Co., Trenton, N. J.
Valve Bag Co. of America, Toledo, O.—see pages 8-9
Western Valve Bag Co., Chicago, Ill.

PACKING PLANTS

Bates Valve Bag Co., Chicago, Ill.
Bland Engineering Co., Minneapolis, Minn.
Burrell Eng. & Const. Co., Chicago, Ill.—see page 237
MacDonald Engineering Co., Chicago, Ill.

PANS—Grinding

Bonnot Co., Canton, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Jackson & Church Co., Saginaw, Mich.
Lewistown Foundry & Machine Co., Lewistown, Penn.—wet and dry—see pages 214-215
The Stevenson Co., Wellsville, O.

PAPER—For Lining Cars

Cleveland-Akron Bag Co., Cleveland, O.—rosin sized sheeting and rag
W. A. Johns Paper Co., Chicago, Ill.
Kennedy Car Liner & Bag Co., Shelbyville, Ind.—see page 236

PAVERS

Chain Belt Co., Milwaukee, Wis.
Koehring Co., Milwaukee, Wis.—see pages 38-39

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Penn.—see page 185
Harrington & King Perforating Co., Chicago, Ill.—see page 249
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
S. Howes & Co., Silver Creek, N. Y.
Johnston & Chapman Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Nortmann-Duffke Co., Milwaukee, Wis.
Pittsburgh Perforating Co., Pittsburgh, Penn.
The Reeves Bros. Co., Alliance, O.—see page 228
Rogers Foundry & Machine Co., Joplin, Mo.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
United Iron Wks., Inc., Kansas City, Mo.—see page 33
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
Wickwire-Spencer Steel Corp., New York, N. Y.
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240

PIGMENTS

The Metro-Nite Co., Milwaukee, Wis.

PILE DRIVERS

Brown Hoisting Machinery Co., Cleveland, O.—see page 1
The Browning Co., Cleveland, O.
The Byers Machine Co., Ravenna, O.—see page 199
Industrial Works, Bay City, Mich.—see page 55
Lidgerwood Mfg. Co., New York, N. Y.—see page 243
J. S. Mundy Hoisting Engine Co., Newark, N. J.
The McMyler-Interstate Co., Cleveland, O.—see page 189
Pawling & Harnischfeger Co., Milwaukee, Wis.

PINIONS—See Gears

PIPE

American Car & Foundry Co., Chicago, Ill.
American Rolling Mill Co., Middletown, O.—Armco ingot—special analysis steel dredge—see page 220
American Spiral Pipe Works, Chicago, Ill.—spiral riveted
The Biggs Boiler Works Co., Akron, O.—steel riveted
Birch Plow Works, Crestline, O.—cast iron
Blaw-Knox Co., Pittsburgh, Penn.
A. M. Byers Co., Pittsburgh, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Colonial Supply Co., Chicago, Ill.
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Crane Co., Chicago, Ill.
L. B. Foster Co., Inc., Pittsburgh, Penn.—see page 252
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—cast iron
Hadfield-Penfield Steel Co., Bucyrus, O.—special—see pages 182-183
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Joshua Hendy Iron Works, San Francisco, Calif.
The Petroleum Iron Works Co. of Ohio, Sharon, Penn.
Reeves Bros. Co., Alliance, O.—see page 228
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223
United Lead Co., New York, N. Y.
Weller Mfg. Co., Chicago, Ill.—see page 240
R. D. Wood & Co., Philadelphia, Penn.—see page 238

PIPE SLEEVES
See Dredge Sleeves

PLASTER MACHINERY

Allis Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Process Co., New York, N. Y.—inside back cover
Butterworth & Lowe, Grand Rapids, Mich.—see page 250
Buttress Plaster Board Mach. Co., Los Angeles, Calif.—plaster board
Coe Mfg. Co., Painesville, O.—plaster and wall board—see pages 230-231
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Union Engineering Co., Cleveland, O.

PLATES—Steel

Bethlehem Steel Co., Bethlehem, Penn.
Biehl Iron Works, Inc., Reading, Penn.
Blaw-Knox Co., Pittsburgh, Penn.
Central Frog & Switch Co., Cincinnati, O.—see page 27
Chicago Bridge & Iron Works, Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Penn.
L. B. Foster Co., Pittsburgh, Penn.—tie—see page 252
Fuller-Lehigh Co., Fullerton, Penn.—all kinds—see page 212
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
The Reeves Bros. Co., Alliance, O.—see page 228

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Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 257
Traylor Engineering & Mfg. Co., Allentown, Penn. —see pages 222-223
Webster Mfg. Co., Chicago, Ill.—see pages 218-219

PORTABLE CONVEYORS

Atlas Engineering Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.—see page 247
Austin-Western Road Machinery Co., Chicago, Ill. —see page 247
Barber-Greene Co., Aurora, Ill.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Dust Recovering & Conveying Co., Cleveland, O.
Godfrey Conveyor Co., Elkhart, Ind.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—see page 188
George Haiss Mfg. Co., New York, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
The Northern Blower Co., Cleveland, O.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—see page 14
Specialty Engineering Co., Philadelphia, Penn.
Standard Conveyor Co., N. St. Paul, Minn.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194

POWER LINE RACK—Portable

France Fdry. & Mach. Co., Toledo, O.

POWER SHOVELS

Bay City Dredge Wks., Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.
Bucyrus Co., So. Milwaukee, Wis.—see page 23
Erie Steam Shovel Co., Erie, Penn.—see page 241
J. B. Ersham & Sons Mfg. Co., Enterprise, Kans. —see page 251
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Koehring Co., Milwaukee, Wis.—see pages 38-39
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Marion Steam Shovel Co., Marion, O.—see page 59
McMyler-Interstate Co., Cleveland, O.—see page 189
Northwest Eng. Co., Chicago, Ill.—see insert between pages 2-3
Orton & Steinbrenner Co., Chicago, Ill.—see page 53
Osgood Co., Marion, O.—see page 54
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ruston & Hornsby, Ltd., Lincoln, England
Thew Shovel Co., Lorain, O.—see page 180

POWER UNITS—Gasoline

Beaver Mfg. Co., Milwaukee, Wis.—see page 251
Buda Mfg. Co., Harvey, Ill.
Climax Eng. Co., Clinton, Ia.—see insert between pages 2-3
Hercules Motor Corp., Canton, O.
Twin City Engine Co., Minneapolis, Minn.
Waukesha Motor Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

PRECIPITATION EQUIPMENT—Electrical

General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.
Western Precipitation Co., Los Angeles, Calif.

PRESSURE BLOWERS

J. R. Alsing Engineering Co., Inc., New York, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186

PULLEYS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
C. G. Buchanan, Inc., New York, N. Y.—see pages 18-19
Buttress Plaster Board Mach. Co., Los Angeles, Calif.—variable speed
H. W. Caldwell & Son, Chicago, Ill.—see page 37
W. E. Caldwell Co., Louisville, Ky.—friction clutch
R. & J. Dick Co., Inc., Passaic, N. J.—steel split
Dodge Mfg. Corp., Mishawaka, Ind.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Mach. & Fdry. Co., Chicago, Ill. —see page 249
W. A. Jones Fdry. & Machine Co., Chicago, Ill.—friction clutch
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Medart Co., St. Louis, Mo.
Morgan Eng. Co., Alliance, O.—see page 239
Munson Mill Machinery Co., Utica, N. Y.—see page 253
O. K. Clutch & Machinery Co., Columbia, Penn.
Palmer-Bee Co., Detroit, Mich.—see page 217
Philip Pressed Steel Pulley Works, Germantown, Penn.—steel split
Plamondon Mfg. Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
T. B. Wood's Sons Co., Chambersburg, Pa.

PULLEYS—Magnetic

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Dings Magnetic Separator Co., Milwaukee, Wis.—see inside front cover
Magnetic Mfg. Co., Milwaukee, Wis.—see page 257

PULVERATORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
J. R. Alsing Eng. Co., Inc., New York, N. Y.

PULVERIZED COAL SYSTEMS

Aero Pulverizer Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Pulverizer Co., St. Louis, Mo.
Bethlehem Steel Co., Bethlehem, Penn.
The Bonnot Co., Canton, O.
L. R. Christie Co., Pittsburgh, Penn.
Combustion Engineering Corp., New York, N. Y.
Erie City Iron Works, Erie, Penn.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Grindle Fuel Equipment Co., Harvey, Ill.
Hardinge Co., New York, N. Y.—see page 3
Hunt, C. W. Co., Staten Island, N. Y.
K-B Pulverizer Corp., Inc., New York, N. Y.—see page 254
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
McGann Mfg. Co., York, Penn.—see page 29
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 42-43
Richardson Scale Co., Passaic, N. J.
Ruggles-Coles Engineering Co., New York, N. Y. —see page 187
F. L. Smidth & Co., New York, N. Y.—see pages 210-211
E. H. Stroud & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 254
Weller Mfg. Co., Chicago, Ill.—see page 240
The Youngstown Boiler & Tank Co., Youngstown, O.

PULVERIZERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
J. R. Alsing Engineering Co., New York, N. Y.
American Pulverizer Co., St. Louis, Mo.
The C. O. Bartlett & Snow Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Penn.
The Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Penn.—see page 52
Brainard Pulverizer Co., Chicago, Ill.
Day Pulverizer Co., Knoxville, Tenn.
Dixie Machinery Mfg. Co., St. Louis, Mo.
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—ring roll—see page 188
Hardinge & Co., New York, N. Y.—see page 3
Alfred Herbert, Ltd., Coventry, England—coal
Jackson & Church Co., Saginaw, Mich.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
K-B Pulverizer Corp., New York, N. Y.—"Pulverburner," all kinds—see page 254
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—roll hammer, ring roll, combination ball tube mills, ball mills, air-swept tube mills for coal, rock or clinker—see page 4
Kent Mill Co., Brooklyn, N. Y.—see page 245
Komnick Machy. Co., Detroit, Mich.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Munson Mill Machinery Co., Utica, N. Y.—see page 253
New Holland Machine Co., New Holland, Penn.—see page 254
Pennsylvania Crusher Co., Philadelphia, Penn.—see pages 24-25
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 42-43
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stearns-Roger Mfg. Co., Denver, Colo.
F. L. Smidth Co., New York, N. Y.—see pages 210-211
E. H. Stroud and Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 257
Traylor Engineering & Mfg. Co., Allentown, Penn. —see pages 222-223
Universal Crusher Co., Cedar Rapids, Ia.—see page 206
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see pages 34-35
O. B. Wise Pulverizer Co., Knoxville, Tenn.

PUMPS

Aldrich Pump Co., Allentown, Penn.—see page 257
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—air, slurry and centrifugal—see page 179
American Air Compressor Works, Brooklyn, N. Y. —vacuum
American Manganese Steel Co., Chicago Heights, Ill.—dredging, sand and gravel—see page 209
American Steam Pump Co., Battle Creek, Mich.
The American Well Works, Aurora, Ill.—centrifugal and deep well
Aurora Pump & Mfg. Co., Aurora, Ill.—deep well and turbine
The Barnes Mfg. Co., Mansfield, O.—water supply and drainage
Beach Mfg. Co., Charlotte, Mich.
W. H. K. Bennett, M. E., Chicago, Ill.
Bethlehem Ship Building Corp., Bethlehem, Penn. —fuel oil, turbo-feed, lubrication feed, condensate and centrifugal
Buffalo Forge Co., Buffalo, N. Y.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pneumatic Tool Co., Mansfield, O.
Colorado Iron Wks., Denver, Colo.—diaphragm
Dayton-Dowd Co., Quincy, Ill.
O. H. Davidson Equipment Co., Denver, Colo.
De Laval Steam Turbine Co., Trenton, N. J.—centrifugal
Dorr Co., New York, N. Y.
Edson Mfg. Corporation, Boston, Mass.—diaphragm
Ellicott Machine Corp., Baltimore, Md.—dredging and sewage
The Emerson Pump & Valve Co., Alexandria, Va.—steam
Erie Pump & Engine Works, Medina, N. Y.—centrifugal dredging
Evinrude Motor Co., Milwaukee, Wis.—centrifugal, high pressure 1½-2 in.
Exeter Machine Works, Inc., W. Pittston, Penn.
Fairbanks, Morse & Co., Chicago, Ill.—centrifugal, piston and plunger
Fairmont Mining Machinery Co., Fairmont, W. Va.
Gilbert & Barker Mfg. Co., Springfield, Mass.—gas and oil
Glamorgan Pipe & Foundry Co., Lynchburg, Va. —centrifugal
Groch Centrifugal Floatation Co., El Paso, Texas
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Ingersoll-Rand Co., New York, N. Y.—centrifugal and direct-acting
Jackson Byron Iron Works, Inc., San Francisco, Calif.
Kansas City Hay Press & Tractor Co., Kansas City, Mo.—sand and dredging—see page 248
Krogh Pump & Machinery Co., San Francisco, Calif.—centrifugal sand
Lansing Motor & Pump Co., Inc., Lansing, Mich.
Link-Belt Meese & Gottfried Co., San Fransico, Calif.—centrifugal
Mine and Smelter Supply Co., Denver, Colo.—see pages 20-21
Morris Machine Co., Baldwinsville, N. Y.—centrifugal, dredging, booster, sand and gravel
F. E. Myers & Bros. Co., Ashland, O.—all kinds
The Norbon Engineering Co., Darby, Penn.—dredge
Novo Engine Co., Lansing, Mich.—centrifugal, diaphragm, deep-well
Nye Steam Pump & Mach. Corp., Chicago, Ill.

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Pennsylvania Pump & Compressor Co., Easton, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—dredging, sand and gravel—see page 184
Pneumelectric Corp., Syracuse, N. Y.
Pulsometer Steam Pump Co., New York, N. Y.—steam
Schramm, Inc., West Chester, Penn.—compressor
F. L. Smidth & Co., New York, N. Y.—slurry—see pages 210-211
Smokeless Oil Burner Co., Bucyrus, O.—see page 254
Sullivan Machinery Co., Chicago, Ill.—air lift and dry vacuum—see page 216
The Superheater Co., New York, N. Y.
Swaby Mfg. Co., Chicago, Ill.—centrifugal, others
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—centrifugal sand—see page 11
Terry Steam Turbine Co., Hartford, Conn.—centrifugal
Union Steam Pump Co., Battle Creek, Mich.
United Iron Wks., Inc., Kansas City, Mo.—see page 33
United Lead Co., New York, N. Y.
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—centrifugal
Weinman Pump Co., Columbus, O.—centrifugal
Westco-Chippewa Pump Co., Davenport, Ia.
A. R. Wilfley & Sons, Denver, Colo.—see page 195
Worthington Pump & Mach. Corp., New York, N. Y.—power, centrifugal, steam and electric

PYROMETERS—THERMOMETERS—TACHOMETERS
Indicating and Recording

The Barnard Mfg. Co., Enterprise, Kans.
Bristol Co., Waterbury, Conn.—see page 248
The Brown Instrument Co., Philadelphia, Penn.
Cleveland Instrument Co., Cleveland, O.
Foxboro Co., Inc., Foxboro, Mass.
The Leeds & Northrup Co., Philadelphia, Penn.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Penn.
Wilson-Maeulen Co., New York, N. Y.

RAIL-LAYING EQUIPMENT
Aldon Co., Chicago, Ill.

RAILWAY EQUIPMENT
Atlas Ry. Supply Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Penn.
Central Frog & Switch Co., Cincinnati, O.—see page 27
L. B. Foster Co., Pittsburgh, Pa.—see page 252
Hyman-Michaels Co., Chicago, Ill.—see page 251
Koppel Industrial Car & Equip. Co., Koppel, Penn.
S. W. Lindheimer Co., Chicago, Ill.
Morrison & Risman Co., Buffalo, N. Y.
Weir Frog Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Penn.
Western Wheeled Scraper Co., Aurora, Ill.—see page 203

RECEIVERS—Air
The Brownell Co., Dayton, O.
The Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Curtis Pneumatic Mchy. Co., St. Louis, Mo.—see page 257
Holly Pneumatic Systems, Inc., New York, N. Y.
Ingersoll-Rand Co., New York, N. Y.
Reeves Bros., Alliance, O.—see page 228
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Worthington Pump and Machinery Corp., New York, N. Y.

REFRACTORIES
(See Fire Brick)

Adams & Jewell, Rome, N. Y.
Betson Plastic Fire Brick Co., Inc., Rome, N. Y.
Chapman-Stein Furnace Co., Mt. Vernon, O.
Celite Products Co., Chicago, Ill.
A. P. Green Firebrick Co., Mexico, Mo.
Harbison-Walker Refractories Co., Pittsburgh, Penn.—see page 51
Johns-Manville, Inc., New York, N. Y.
Quigley Furnace Specialties Co., New York, N. Y.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Wahl Refractory Products Co., Fremont, O.

RELAYING RAILS
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Central Frog & Switch Co., Cincinnati, O.—see page 27
L. B. Foster Co., Inc., Pittsburgh, Penn.—see page 252
M. K. Frank, Pittsburgh, Penn.
Hyman-Michaels Co., Chicago, Ill.—see page 251
S. W. Lindheimer Co., Chicago, Ill.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.

ROAD MACHINERY—Rollers, Graders, Spreaders, Planers, Plows
Acme Road Mchy. Co., Frankfort, N. Y.
Austin Manufacturing Co., Chicago, Ill.—see page 247
The Austin Western Road Machinery Co., Chicago, Ill.—see page 247
The Burch Plow Works Co., Crestline, O.
The Galion Iron Works & Mfg. Co., Galion, O.
Good Roads Machinery Co., Kennett Square, Penn.—see page 40
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Ruggles-Coles Eng. Co., New York, N. Y.—see page 187
Sanford-Day Iron Works, Knoxville, Tenn.
The Sunbury Mfg. Co., Sanbury, O.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Universal Road Machinery Co., Kingston, N. Y.—see page 250
Webb City & Carterville Fdy. & Mach. Wks., Webb City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.—see page 203

ROLLER BEARINGS—See Bearings
Hyatt Roller Bearing Co., New York, N. Y.
Norma Co. of America, Long Island City, N. J.
Timken Roller Bearing Co., Canton, O.—see page 41

SAND GRINDING PANS
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Jackson & Church Co., Saginaw, Mich.
Komnick Machy. Co., Detroit, Mich.
Lewistown Fdy. & Mach. Corp., Lewistown, Pa.—see pages 214-215

SAND TANKS
Allen Cone Co., El Paso, Texas
W. H. K. Bennett, M. E., Chicago, Ill.
Columbia Steel Tank Co., Kansas City, Mo.
Duff Patents Co., Inc., Pittsburgh, Penn.
Greenville Mfg. Co., Greenville, O.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Smith Engineering Works, Milwaukee, Wis.—see page 239
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245

SCALES
Automatic Weighing Machine Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.—all types
The Howe Scale Co. of N. Y., New York, N. Y.
Merrick Scale Mfg. Co., Passaic, N. J.—automatic, conveyor, weightometers—see page 225
Richardson Scale Co., Passaic, N. J.
Schaffer Poidometer Co., Pittsburgh, Penn.—see page 256
Standard Scale & Supply Corp., Pittsburgh, Penn.
Strait Scale Co., Kansas City, Mo.
Sturtevant Mill Co., Boston, Mass.—hopper and bagging—see page 257
Toledo Scale Co., Toledo, O.
Winslow Government Standard Scale Wks., Inc., Terre Haute, Ind.

SCRAPERS
The Austin-Western Road Machinery Co., Chicago, Ill.—dump and wheeled—see page 247
Baker Mfg. Co., Springfield, Ill.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Penn.—cable drag
Burch Plow Works, Crestline, O.
L. P. Green, Chicago, Ill.—drag
Good Roads Machinery Co., Kennett Square, Penn.—see page 40
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.
Miami Trailer Scraper Co., Troy, O.—one man power
Sauerman Bros., Chicago, Ill.—drag and bottomless power—see page 229
Schofield-Burkett Construction Co., Macon, Ga.
The Sunbury Mfg. Co., Sunbury, O.
Western Wheeled Scraper Co., Aurora, Ill.—wheeled and drag—see page 203

SCREEN NOZZLES
Swintek Traveling Suction Screen Co., Eddyville, Ia.—cutterhead

ROCK DRILLS
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ROLLER DRYERS
The Coe Mfg. Co., Painesville, O.—see pages 230-231

ROOFING AND SIDING MATERIAL
American Sheet & Tin Plate Co., Pittsburgh, Penn.
American Rolling Mill Co., Middletown, O.—Armco ingot iron—see page 220
Bethlehem Steel Co., Bethlehem, Penn.
Illinois Zinc Co., Chicago, Ill.
Johns-Manville, Inc., New York, N. Y.—asbestos
Newport Rolling Mill Co., Newport, Ky.
H. H. Robertson Co., Pittsburgh, Penn.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.
United Alloy Steel Co., Masillon, O.—toncan metal

ROOFING TILE MACHINES
Concrete Tile Machy. Co., Cicero, Ill.—see page 224

ROPE—Wire
American Steel & Wire Co., Chicago, Ill.—see page 254
American Cable Co., New York, N. Y.
Beach Mfg. Co., Charlotte, Mich.
Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Sales & Eng. Co., Mishawaka, Ind.
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 288
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
Geo. C. Moon Co., Garwood, N. J.
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—see page 12

RUST PREVENTIVES
Dearborn Chemical Co., Chicago, Ill.
Detroit Graphite Co., Detroit, Mich.
Joseph Dixon Crucible Co., Jersey City, N. J.
Smooth-On Mfg. Co., Jersey City, N. J.

SAFETY DEVICES—Goggles, Respirators, Etc.
Barnard Machinery Co., Enterprise, Kans.
Chicago Eye Shield Co., Chicago, Ill.
Cleveland Railway Supply Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Penn.
Electric Arc Cutting & Welding Co., Newark, N. J.
Foamite-Childs Corp., Utica, N. Y.
Mine Safety Appliances Co., Pittsburgh, Penn.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Penn.
Willson Goggles, Inc., Reading, Penn.

SAND CONES
Allen Cone Co., El Paso, Texas
W. H. K. Bennett, M. E., Chicago, Ill.
Greenville Mfg. Co., Greenville, O.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—revolving, shaking, conical—see page 129
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Audubon Wire Cloth Co., Inc., Audubon, N. J.
Austin Manufacturing Co., Chicago, Ill.—see page 247
Austin-Western Road Machinery Co., Chicago, Ill.—see page 247
Earle C. Bacon, Inc., New York, N. Y.—see page 46
Beach Mfg. Co., Charlotte, Mich.
C. O. Bartlett & Snow Co., Cleveland, O.
C. G. Buchanan Co., Inc., New York, N. Y.—revolving—see pages 18-19
Buffalo Wire Works, Buffalo, N. Y.

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C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—revolving, shaking, gravity
The Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—see page 192
Colorado Iron Works, Denver, Colo.—vibrating
Coyle & Roth, Minneapolis, Minn.
Cross Engineering Co., Carbondale, Penn.—see page 185
Dodge Mfg. Co., Mishawaka, Ind.—bar and trommel
Ebersol Eng. Co., Blue Ball, Lancaster Co., Pa.—see page 244
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 251
Exeter Machine Works, Inc., West Pittston, Penn.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Galion Iron Works, Galion, O.
Rupert M. Gay Co., New York, N. Y.—see page 60
Good Roads Machinery Co., Inc., Kennett Square, Penn.—revolving—see page 40
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Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
S. Howes Co., Silver Creek, N. Y.
The Geo. Haiss Mfg. Co., New York, N. Y.
Hardinge Co., New York, N. Y.—see page 3
Harrington & King Perforating Co., Chicago, Ill.—see page 249
Hendrick Mfg. Co., Carbondale, Penn.—revolving—see page 260
Joshua Hendy Iron Works, San Francisco, Calif.
Hesse-Ersted Iron Works, Portland, Ore.—revolving
Iowa Mfg. Co., Cedar Rapids, Ia.
The Jeffrey Mfg. Co., Columbus, O.—shaking—see pages 226-227
Johnston & Chapman Co., Chicago, Ill.—cylindrical and conical
Kennedy-Van Saun Mfg. & Eng. Corp., New York City, N. Y.—revolving, gravity, grizzly, pulsating, Maxton, conical—see page 3
Komnick Machy. Co., Detroit, Mich.
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Lewistown Foundry & Machine Co., Lewistown, Penn.—see pages 214-215
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—cylindrical
Littleford Bros., Cincinnati, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.—see page 63
Manganese Steel Forge Co., Philadelphia, Penn.—see page 257
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—all kinds—see page 250
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
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The Orville Simpson Co., Cincinnati, O.—Rotex and vibrating—see page 49
Pioneer Tractors Co., Winona, Minn.
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Rogers Foundry & Mfg. Co., Joplin, Mo.
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Smith Engineering Works, Milwaukee, Wis.—rotary—see page 239
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Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—cylindrical—see page 194
Stevenson Co., Wellsville, O.
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W. Toepfer & Sons Co., Milwaukee, Wis.—revolving—see page 245
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The W. S. Tyler Co., Cleveland, O.—electrical vibrating and woven wire—see page 257
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Union Chain & Mfg. Co., Sandusky, O.—see page 256
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Universal Crusher Co., Cedar Rapids, Ia.—see page 206
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Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—trunnion and trommell
Webster Mfg. Co., Chicago, Ill.—revolving and shaking—see pages 218-219
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Western Wheeled Scraper Co., Aurora, Ill.—revolving—see page 203
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Kennedy Van-Saun Mfg. & Eng. Co., New York, N. Y.—see page 4
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Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Simplex Screen Co., Salt Lake City, Utah
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SCREENS, VIBRATING

Colorado Iron Works Co., Denver, Colo.
C. W. Hunt Co., Staten Island, N. Y.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
National Engineering Co., Chicago, Ill.—vibrating
Orville-Simpson Co., Cincinnati, O.—see page 49
Sturtevant Mill Co., Boston, Mass.—see page 257
Southwestern Engineering Co., Los Angeles, Calif.—vibrating
W. S. Tyler Co., Cleveland, O.—see page 257
Universal Vibrating Screen Co., Racine, Wis.—see page 7

SEPARATORS—Air

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The Northern Blower Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Penn.—see page 253
W. W. Sly Mfg. Co., Cleveland, O.—see page 193
Williams Pat. Crusher & Pulv. Co., St. Louis, Mo.—see pages 34-35

SEPARATORS—Magnetic

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Electric Controller & Mfg. Co., Cleveland, O.
S. Howes Co., Inc., Silver Creek, N. Y.
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SHEAVES

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American Manganese Steel Co., Chicago Heights, Ill.—see page 209
American Hoist & Derrick Co., St. Paul, Minn.—see page 251
American Steel & Wire Co., Chicago, Ill.—see page 254
Baker Car Co., Harriman, Tenn.
Beach Mfg. Co., Charlotte, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
C. S. Card Iron Works Co., Denver, Colo.
Clyde Iron Works, Duluth, Minn.
Conveyors Corp. of America, Chicago, Ill.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
Dodge Mfg. Co., Mishawaka, Ind.
Godfrey Conveyor Co., Elkhart, Ind.
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
The Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Hockensmith Wheel & Mine Car Co., Penn, Penn.
John T. Horton Co., Inc., New York, N. Y.
Indiana Foundry Co., Inc., Indiana, Penn.
Inland Engineering Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Medart Co., St. Louis, Mo.
The Mining Machine Co., Mountville, Pa.—steel
Morgan Eng. Co., Alliance, O.—see page 239
Newhall Chain Forge & Iron Co., New York, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Ottumwa Iron Works, Ottumwa, Ia.—see page 242
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
John A. Roebling's Sons Co., Trenton, N. J.
Sanford-Day Iron Works, Knoxville, Tenn.
Schofield-Burkett Construction Co., Macon, Ga.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Upson-Walton Co., Cleveland, O.
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Wellman-Seaver-Morgan Co., Cleveland, O.
Williamsport Wire Rope Co., Williamsport, Penn.—see page 12
T. B. Wood's Sons Co., Chambersburg, Penn.

SHIELDS—Eye, Face, Body

Chicago Eye Shield Co., Chicago, Ill.
Electric Arc Cutting & Welding Co., Newark, N. J.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Penn.

SHOVELS—Diesel or Oil

Bucyrus Co., S. Milwaukee, Wis.—see page 23
Pawling & Harnischfeger Co., Milwaukee, Wis.

SHOVELS—Gasoline and Electric

Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Bucyrus Co., South Milwaukee, Wis.—see page 23
Byers Machine Co., Ravenna, O.—see page 199
Hoar Shovel Co., Duluth, Minn.
Industrial Works, Bay City, Mich.—see page 55
Insley Mfg. Co., Indianapolis, Ind.
Koehring Co., Milwaukee, Wis.—see pages 38-39
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Marion Steam Shovel Co., Marion, O.—see page 59
The McMyler-Interstate Co., Cleveland, O.—see page 189
Myers-Whaley Co., Knoxville, Tenn.
Northwest Engineering Co., Chicago, Ill.—see insert between pages 2-3
Orton & Steinbrenner Co., Chicago, Ill.—see page 53
Pawling & Harnischfeger Co., Milwaukee, Wis.
The Thew Shovel Co., Lorain, O.—see page 180

SHOVELS—Steam

American Hoist & Derrick Co., St. Paul, Minn.—steam—see page 251
Austin Machinery Corp., Toledo, O.—steam, gas and electric
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.—all types—see page 23
Erie Steam Shovel Co., Erie, Penn.—see page 241
Industrial Works, Bay City, Mich.—combination crane-steam shovels—see page 55
Link-Belt Co., Chicago, Ill.—power-automatic—see page 5 and back cover
The Marion Steam Shovel Co., Marion, O.—see page 59
The McMyler-Interstate Co., Cleveland, Ohio—see page 189
Orton & Steinbrenner, Chicago, Ill.—steam—see page 53
Osgood Co., Marion, O.—steam—see page 54
Pawling & Harnischfeger Co., Milwaukee, Wis.
The Thew Shovel Co., Lorain, O.—steam, gasoline and electric—see page 180

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SHOVELS—Hand
The Wood Shovel & Tool Co., Piqua, O.
Wyoming Shovel Works, Wyoming, Penn.

SKIPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Hoist & Derrick Co., St. Paul, Minn.—see page 251
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Earle C. Bacon, Inc., New York, N. Y.—see page 46
C. O. Bartlett & Snow Co., Cleveland, O.
The Biehl Iron Works, Inc., Reading, Penn.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Guarantee Construction Co., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Insley Mfg. Co., Indianapolis, Ind.
Joshua Hendy Iron Works, San Francisco, Calif.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Koppel Industrial Car & Equipment Co., Koppel, Penn.
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Penn Foundry & Mfg. Co., Reading, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Vulcan Iron Works, Wilkes-Barre, Penn.—see page 233
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—seet page 240

SLATE WORKING MACHINERY
S. Flory Mfg. Co., Bangor, Penn.—saw beds, planers, rubbing beds, grooving attachments—see page 257
Ruggles Machine Co., Poultney, Vt.
Sullivan Machinery Co., Chicago, Ill.—see page 216

SPECIFIC GRAVITY APPARATUS (For Cement)
E. H. Sargent & Co., Chicago, Ill.

SPEED TRANSFORMERS
Allis Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
The Cleveland Worm & Gear Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.
Falk Corp., Milwaukee, Wis.
Farrell Foundry & Machine Co., Buffalo, N. Y.
Foote Bros. Gear & Machine Co., Chicago, Ill.—see page 15
Wm. Ganschow Co., Chicago, Ill.
Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
D. O. James Manufacturing Co., Chicago, Ill.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Lewis Fdry. & Mach. Co., Pittsburgh, Penn.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
R. D. Nuttall Co., Pittsburgh, Penn.
Palmer-Bee Co., Detroit, Mich.—see page 217
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Eng. & Machine Co., Baltimore, Md.—see page 256
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
The Terry Steam Turbine Co., Hartford, Conn.
Weller Mfg. Co., Chicago, Ill.—see page 240

SPROCKETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
C. O. Bartlett & Snow Co., Cleveland, O.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Foote Bros. Gear & Machine Co., Chicago, Ill.—see page 15
Fuller-Lehigh Co., Fullerton, Penn.—see page 212
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Mach. & Fdry. Co., Cleveland, O.—see page 249
Howe Chain Co., Muskegon, Mich.—see page 221
Inland Engineering Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.—silent chain—see page 10
R. D. Nuttall Co., Pittsburgh, Penn.
Palmer-Bee Co., Detroit, Mich.—see page 217
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Robins Conveying Belt Co., New York, N. Y.—see page 14
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Stroh Steel-Hardening Process Co., Pittsburgh, Penn.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11
Union Chain & Mfg. Co., Sandusky, O.—see page 256
The Webster Mfg. Co., Chicago, Ill.—see pages 218-219
The Weller Mfg. Co., Chicago, Ill.—see page 240

STACKS
The Biggs Boiler Works Co., Akron, O.
Brownell Co., Dayton, O.
Chicago Bridge & Iron Works, Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Penn.
Heil Co., Milwaukee, Wis.
Heine Boiler Co., St. Louis, Mo.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Jackson & Church Co., Saginaw, Mich.
Littleford Bros., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn.
The Reeves Bros. Co., Alliance, O.—see page 228
J. S. Schofield's Sons Co., Macon, Ga.—see page 234-235
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Traylor Engineering & Mfg. Co., Allentown, Penn.—see pages 222-223

STEAM ENGINES
See Engines

STEAM SHOVEL REPAIR PARTS
American Maganese Steel Co., Chicago Heights, Ill.—see page 209
Bucyrus Co., South Milwaukee, Wis.—see page 23
Electric Manganese Steel Co., Reading, Penn.—see page 213
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Inland Engineering Co., Chicago, Ill.
Moore & Moore, Inc., Reading, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Philadelphia Steel & Iron Co., Philadelphia, Penn.
Stroh Steel Hardening Co., Pittsburgh, Penn.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11

STONE GRAPPLES
Superior Iron Works, Superior, Wis.

STONE SCRUBBERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Greenville Mfg. Co., Greenville, O.
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Smith Engineering Works, Milwaukee, Wis.—see page 239
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223

STORAGE—Cement Silo
Bland Eng. Co., Minneapolis, Minn.
Burrell Eng. & Const. Co., Chicago, Ill.—see page 237
Doolittle-Stephens Ltd., Hagersville, Ont., Can.—see page 19
Guarantee Construction Co., New York, N. Y.
MacDonald Engineering Co., Chicago, Ill.
F. L. Smidth & Co., New York, N. Y.—see pages 210-211

STORAGE SYSTEMS—Oil and Gas
S. F. Bowser & Co., Ft. Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

STRUCTURAL STEEL WORK
American Bridge Co., Chicago, Ill.
The Austin Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bethlehem Steel Co., Bethlehem, Penn.
Blaw-Knox Co., Pittsburgh, Penn.
Exeter Machine Works, Inc., West Pittston, Penn.
Gehret Bros., Inc., Bridgeport, Penn.
Hendricks Mfg. Co., Carbondale, Penn.—see page 260
Insley Mfg. Co., Indianapolis, Ind.
The McMyler-Interstate Co., Cleveland, O.—see page 189
The Northern Blower Co., Cleveland, O.
Manitowoc Shipbuilding Corp., Manitowoc, Wis.—see page 50
Penn Bridge Co., New York, N. Y.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn.
United Iron Wks., Inc., Kansas City, Mo.—see page 33
Weller Mfg. Co., Chicago, Ill.—see page 240

STUCCO FACINGS
Crown Point Spar Co., Inc., New York, N. Y.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.
Middlebury Marble Co., Brandon, Vt.
Vermont Milling Products Corp., Poultney, Vt.—granules, chips

SUPERHEATERS
Babcock & Wilcox Co., New York, N. Y.
Power Specialty Co., New York, N. Y.—air heaters, fuel economizers
The Superheater Co., New York, N. Y.—locomotives, power plants, steam shovels

SURVEYING INSTRUMENTS
Kalesch & Co., New York, N. Y.—see page 248

SWITCHES—Electrical
The Automatic Reclosing Circuit Breaker Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
The Electric Controller & Mfg. Co., Cleveland, O.—automatic
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

TANKS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Allen Cone Co., El Paso, Texas—dewatering, sand washing, thickening, etc.
American Spiral Pipe Works, Chicago, Ill.
Bethlehem Ship Building Corp., Bethlehem, Penn.
The Biggs Boiler Works Co., Akron, O.
Blaw-Knox Co., Pittsburgh, Penn.
S. F. Bowser Co., Inc., Ft. Wayne, Ind.—gasoline and oil
The Brownell Co., Dayton, O.
W. E. Caldwell Co., Louisville, Ky.—wood, steel and galvanized
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Coatsville Boiler Works, Philadelphia, Penn.
Gehret Bros., Bridgeport, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbia Steel Tank Co., Kansas City, Mo.
Conveyors Corp. of America, Chicago, Ill.
The Dorr Co., New York, N. Y.
Duff Patents Co., Inc., Pittsburgh, Penn.
Erie City Iron Works, Erie, Penn.
Gilbert & Barker Mfg. Co., Springfield, Mass.
The Greenville Mfg. Co., Greenville, O.—steel, automatic and settling
The Heil Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Penn.—see page 260
Littleford Bros., Cincinnati, O.
Manitowoc Ship Building Corp., Manitowoc, Wis.—see page 50
McGann Manufacturing Co., Inc., York, Penn.—see page 29
The Northern Blower Co., Cleveland, O.
Petroleum Iron Works Co. of Ohio, Sharon, Penn.—water
Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn.
The Reeves Bros. Co., Alliance, O.—see page 228
Smith Eng. Works, Milwaukee, Wis.—sand—see page 239
Standard Steel Works, North Kansas City, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—storage—see page 194
Steacy-Schmidt Mfg. Co., New York, N. Y.

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Stearns-Rogers Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 257
W. Toepfer & Sons Co., Milwaukee, Wis.—sand settling—see page 245
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
United Iron Wks., Inc., Kansas City, Mo.—see page 33
United Lead Co., New York, N. Y.
Walsh & Widner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.—storage tanks.
Weller Mfg. Co., Chicago, Ill.—see page 240
Youngstown Boiler & Tank Co., Youngstown, O.

TANKS—Pressure

Columbian Steel Tank Co., Kansas City, Mo.
Heil Co., Milwaukee, Wis.
Wm. B. Scaife & Sons Co., Oakmont, Penn.
Steacy-Schmidt Mfg. Co., New York, N. Y.

TARPAULINS

Cleveland Akron Bag Co., Cleveland, O.
Upson-Walton Co., Cleveland, O.

TEETH—Dipper

American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11

TESTING LABORATORIES

Geo. Borrowman, Ph.D., Chicago, Ill.
The Dorr Co., New York, N. Y.
Robt. W. Hunt & Co., Chicago, Ill.—see page 254
H. Miscampbell, Duluth, Minn.—see pages 30-31
Pittsburgh Testing Laboratories, Pittsburgh, Penn.
H. Wiedeman, Chemist, St. Louis, Mo.

TESTING MACHINERY

Braun Corp., Los Angeles, Calif.
Eimer & Amend, New York, N. Y.
Riehle Bros. Testing Machine Co., Philadelphia, Penn.
E. H. Sargent & Co., Chicago, Ill.
Thwing Instrument Co., Philadelphia, Penn.
Tinius Olsen Testing Machine Co., Philadelphia, Penn.

TESTING SIEVES AND SHAKERS

Hendrick Mfg. Co., Carbondale, Pa.—see page 260
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 257
The W. S. Tyler Co., Cleveland, O.—see page 257
Newark Wire Cloth Co., Newark, N. J.—see page 249

THERMOMETERS
(See Pyrometers)

THICKENERS
(See Agitators)

TIGHTENERS—Automatic

H. W. Caldwell & Son Co., Chicago, Ill.—see page 37
Hill Clutch Machinery & Foundry Co., Cleveland, O.—see page 249
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gotfried, San Francisco, Calif.
F. L. Smidth Co., New York, N. Y.—see pages 210-211
T. B. Wood's Sons Co., Chambersburg, Penn.

TILE MACHINERY

Besser Sales Co., Chicago, Ill.—concrete
Buttress Plaster Board Machinery Co., Los Angeles, Calif.—gypsum
W. E. Dunn Manufacturing Co., Holland, Mich.—concrete
Concrete Tile Machinery Co., Cicero, Ill.—concrete roofing—see page 224
Shope Brick Co., Portland, Ore.—concrete floor

TOOL STEEL

Bethlehem Steel Co., Bethlehem, Penn.
Colonial Steel Co., Pittsburgh, Penn.—see page 237
The Midvale Co., Philadelphia, Penn.—see page 48

TRACK EQUIPMENT

Aldon Co., Chicago, Ill.
American Frog & Switch Co., Hamilton, O.
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Bethlehem Steel Co., Bethlehem, Pa.
The Biehl Iron Works, Inc., Reading, Pa.
The Buda Co., Harvey, Ill.
C. S. Card Iron Works, Denver, Colo.
Central Frog & Switch Co., Cincinnati, O.—see page 27
Cincinnati Frog & Switch Co., Cincinnati, O.
The Cleveland Railway Supply Co., Cleveland, O.
Co-operative Utilities Co., Philadelphia, Pa.
Easton Car & Construction Co., New York, N. Y.—see page 204
Elliott Frog & Switch Co., East St. Louis, Ill.
Fairmont Mining Machinery Co., Fairmont, W. Va.
L. B. Foster Co., Pittsburgh, Penn.—see page 252
M. K. Frank, Pittsburgh, Pa.
The Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
C. W. Hunt & Co., Inc., Staten Island, N. Y.
The Hyde & Co., Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.—see page 251
International Clay Machinery Co., Dayton, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.
Lakewood Eng. Co., Cleveland, O.
Maris Bros., Philadelphia, Penn.
Palmer-Bee Co., Detroit, Mich.—see page 217
Pettibone Mulliken Co., Chicago, Ill.—see page 184
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11
Weir Frog Co., Cincinnati, O.
Western Wheeled Scraper Co., Aurora, Ill.—see page 203

TRACTORS

Adamson Motor Co., Birmingham, Ala.—see page 36
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Bates Machine & Tractor Co., Joliet, Ill.
C. L. Best Tractor Co., San Leandro, Calif.
Brookville Truck & Tractor Co., Brookville, Pa.—see page 236
Clark Tructractor Co., Chicago, Ill.—dump
Ford Motor Co., Detroit, Mich.—see page 57
I. T. Tractor Co., Cleveland, O.
Kansas City Hay Press Co., Kansas City, Mo.—see page 248
Minneapolis Steel & Mchy Co., Minneapolis, Minn.
Pioneer Tractors, Winona, Minn.
Traylor Eng. & Mfg. Co., Allentown, Penn.—see pages 222-223
Yale & Towne Mfg. Co., Stamford, Conn.

TRACK SHIFTERS

Clyde Iron Works, Duluth, Minn.
Nordberg Mfg. Co., Milwaukee, Wis.

TRAILERS

Easton Car & Const. Co., Easton, Penn.—see page 204
Miami Trailer and Scraper Co., Troy, O.
Yale & Towne Mfg. Co., Stamford, Conn.

TRANSFORMERS
(See Electric Motors)

TRANSMISSION MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
American Manganese Steel Co., Chicago Heights, Ill.—see page 209
The Baldwin Chain & Mfg. Co., Worcester, Mass.
W. E. Caldwell Co., Louisville, Ky.
The H. W. Caldwell & Sons Co., Chicago, Ill.—see page 37
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
Cleveland Worm & Gear Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Penn.
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Ken.—see page 251
Falk Corporation, Milwaukee, Wis.
Fawcus Machine Co., Pittsburgh, Penn.
Foote Bros. Gear & Machine Co., Chicago, Ill.—see page 15
Frost Drive Co., Worcester, Mass.
Wm. Ganschow Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N. Y.
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 188
The Hanson Clutch & Machinery Co., Tiffin, O.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Mach. & Fdry. Co., Cleveland, O.—parts—see page 249
Howe Chain Co., Muskegon, Mich.—see page 221
Hyatt Roller Bearing Co., New York, N. Y.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 4
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
W. F. Mosser & Son, Allentown, Penn.
Morse Chain Co., Ithaca, N. Y.
Munson Mill Machinery Co., Inc., Utica, N. Y.—see page 253
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Chicago, Ill.
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Phillips Pressed Steel Pulley Works, Philadelphia, Penn.
Plamondon Mfg. Co., Chicago, Ill.
Poole Engineering & Machinery Co., Baltimore, Md.—see page 256
Palmer-Bee Co., Detroit, Mich.—see page 217
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
Smith & Serrell, Newark, N. J.
Stearns-Roger Mfg. Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 257
Tool Steel Gear & Pinion Co., Cincinnati, O.
Union Eng. Co., Cleveland, O.
Union Chain & Mfg. Co., Sandusky, O.—see page 256
Webster Mfg. Co., Chicago, Ill.—see pages 218-219
Weller Mfg. Co., Chicago, Ill.—see page 240
Williams Pat. Crusher & Pulverizer Co., St. Louis, Mo.—see pages 34-35

TROLLEYS—Single I-Beam

Curtis Pneumatic Mchy. Co., St. Louis, Mo.—see page 256
Palmer-Bee Co., Detroit, Mich.—see page 217
Yale & Towne Mfg. Co., Stamford, Conn.
Wright Mfg. Co., Lisbon, O.

TRUCKS—Car

The Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Pa.
Brookville Truck & Tractor Co., Brookville, Penn.—see page 236
Easton Car & Construction Co., Easton, Penn.—see page 204
Gustafson Mfg. Co., Chattanooga, Tenn.
Hockensmith Mine Car Co., Penns, Penn.
Koppel Industrial Car & Equipment Co., Koppel, Penn.
Lakewood Engineering Co., Cleveland, O.
Ottumwa Iron Works, Ottumwa, Ia.—patented roller bearings—see page 242
Penn Foundry & Mfg. Co., Reading, Penn.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Watt Mining Car Wheel Co., Barnesville, O.
Western-Wheeled Scraper Co., Aurora, Ill.—see page 203

TUNNELING MACHINES

Hoar Shovel Co., Duluth, Minn.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Myers-Whaley Co., Knoxville, Tenn.
Nordberg Mfg. Co., Milwaukee, Wis.
The Thew Shovel Co., Lorain, O.—see page 180

TURBINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
De Laval Steam Turbine Co., Trenton, N. J.—steam
General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Corp., Wellsville, N. Y.
B. F. Sturtevant Co., Boston, Mass.
The Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

TURNTABLES

Atlas Car & Mfg. Co., Cleveland, O.—see page 243
Bethlehem Steel Co., Bethlehem, Penn.
Hunt, C. W. Co., Staten Island, N. Y.
Jackson & Church Co., Saginaw, Mich.
Komnick Machy. Co., Detroit, Mich.
Koppel-Industrial Car & Equip. Co., Koppel, Penn.
Lakewood Eng. Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.—see page 217
Steacy-Schmidt Mfg. Co., New York, N. Y.

UNDERGROUND LOADERS

Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Hoar Shovel Co., Duluth, Minn.
Jeffrey Mfg. Co., Columbus, O.—see pages 226-227
Myers-Whaley Co., Knoxville, Tenn.

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The Thew Shovel Co., Lorain, O.—see page 180

VALVES
Bay City Foundry & Machine Co., Bay City, Mich.
A. W. Cadman Mfg. Co., Pittsburgh, Penn.
Cleveland Rock Drill Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Penn.
Crane Co., Chicago, Ill.
R. & J. Dick Co., Inc., Passaic, N. J.
Dixon Valve & Coupling Co., Philadelphia, Penn.
The Emerson Pump & Valve Co., Alexandria, Va.
B. F. Goodrich Rubber Co., Akron, O.
Jenkins Bros., New York, N. Y.
Kelly & Jones Co., Greensburg, Penn.
Knox Mfg. Co., Philadelphia, Penn.—steam throttle —see page 201
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mine & Smelter Supply Co., Denver, Colo.—see pages 20-21
Nelson Valve Co., Philadelphia, Penn.
Philadelphia Steel & Iron Co., Philadelphia, Penn.
Quaker City Rubber Co., Philadelphia, Penn.
United Lead Co., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.

VENTILATING EQUIPMENT
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186

VICAT APPARATUS
E. H. Sargent & Co., Chicago, Ill.

WAGONS
The Austin-Western Road Machinery Co., Chicago, Ill.—see page 247
The Greenville Mfg. Co., Greenville, O.
Troy Wagon Works, Troy, O.
Western Wheeled Scraper Co., Aurora, Ill.—dump —see page 203

WASHERS
Allen Cone Co., El Paso, Texas
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 179
Bethlehem Steel Co., Bethlehem, Penn.
Diester Concentrator Co., Ft. Wayne, Ind.
Dorr Co., New York, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Penn.—see page 40
Greenville Mfg. Co., Greenville, O.
Lewistown Foundry & Machine Co., Lewistown, Penn.—see pages 214-215
Link-Belt Co., Chicago, Ill.—see page 5 and back cover
McLanahan-Stone Machine Co., Hollidaysburg, Penn.—see page 250
Smith Eng. Works, Milwaukee, Wis.—sand and gravel—see page 239
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 194
The Stevenson Co., Wellsville, O.—screw
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 245
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WASHERS—Air
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.—see page 186
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WASTE HEAT SYSTEMS
Babcock & Wilcox Co., New York, N. Y.
Edge Moor Iron Co., Edge Moor, Del.
Glamorgan Pipe Foundry Co., Lynchburg, Va.—continuous pulp
Wickes Boiler Co., Saginaw, Mich.

WATER SOFTENING SYSTEMS
Chicago Bridge & Iron Works, Chicago, Ill.
Dearborn Chemical Co., Chicago, Ill.
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Scientific Boiler Chemical Works, Chicago, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

WEIGHING EQUIPMENT
Automatic Weighing Machine Co., New York, N. Y.
Bates Valve Bag Co., Chicago, Ill.
Merrick Scale Mfg. Co., Passaic, N. J.—automatic—see page 225
Richardson Scale Co., Passaic, N. J.—automatic
Schaffer Poidometer Co., Pittsburgh, Penn.—see page 256
Western Engineering & Mfg. Co., Chicago, Ill.
Valve Bag Co. of America, Toledo, O.—see pages 8-9
Western Valve Bag Co., Chicago, Ill.

WELDING AND CUTTING EQUIPMENT
Aeroil Burner Co., Inc., Union Hill, N. J.
The Alexander Milburn Co., Baltimore, Md.
Allan Mfg. & Welding Corp., Buffalo, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass. —welding tubing—see page 6
Burke Electric Co., Erie, Penn.—see page 252
The Champion Blower & Forge Co., Lancaster, Penn.
O. H. Davidson Equipment Co., Denver, Colo.
Electric Arc Cutting & Welding Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
The Lincoln Electric Co., Cleveland, O.
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The Ohio Brass Co., Mansfield, O.
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H. N. Strait Co., Kansas City, Mo.
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American Manganese Steel Co., Chicago Heights, Ill.—see page 209
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Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Penn.
The Buda Co., Harvey, Ill.—cast iron, steel
C. S. Card Iron Works Co., Denver, Colo.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
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Griffin Wheel Co., Chicago, Ill.
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Hadfield-Penfield Steel Co., Bucyrus, O.—see pages 182-183
Helm Brick Machine Co., Cadillac, Mich.
Joshua Hendy Iron Works, San Francisco, Calif.
Hill Clutch Machine & Foundry Co., Cleveland, O.—see page 249
Hockensmith Wheel & Mine Car Co., Penns, Penn.
Kenova Mine Car Co., Kenova, W. Va.
Koppel Industrial Car & Equip. Co., Koppel, Penn.
Lake Shore Engine Wks., Marquette, Mich.
Lobdell Car Wheel Co., Wilmington, Del.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Ogden Iron Works, Ogden, Utah
Ottumwa Iron Works, Ottumwa, Ia.—see page 242
Pennsylvania Casting & Machine Works, Pittsburgh, Penn.
Pettibone-Mulliken Co., Chicago, Ill.—see page 184
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Stroh-Steel-Hardening Process Co., Pittsburgh, Penn.—sheave, car, crane track
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 11
Watt Mining Car Wheel Co., Barnesville, O.

WINCHES AND CAPSTANS
American Hoist & Derrick Co., St. Paul, Minn.—see page 251
Bay City Foundry & Machine Co., Bay City, Mich.
Bethlehem Shipbuilding Corp., Bethlehem, Penn.
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Chicago Pneumatic Tool Co., New York, N. Y.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
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Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mining Machine Co., Mountville, Penn.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
Ottumwa Box Car Loader Co., Ottumwa, Ia.
Standard Steel Works, North Kansas City, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—hand— see page 194
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WIRE CLOTH
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American Wire Fabrics Corp., New York, N. Y.
Buffalo Wire Works Co., Buffalo, N. Y.
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Ludlow-Saylor Wire Co., St. Louis, Mo.—see page 63
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Newark Wire Cloth Co., Newark, N. J.—see page 249
Twin City Iron & Wire Co., St. Paul, Minn.
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Wickwire Spencer Steel Corp., New York, N. Y.
G. F. Wright Steel & Wire Co., Worcester, Mass.

WIRE ROPE
Cableway, Conveyor, Crane, Derrick, Dredge, Guy, Hoisting, Loading Machinery, Mining, Haulage, Steam Shovel

American Cable Co., New York, N. Y.
American Steel & Wire Co., Chicago, Ill.—see page 254
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Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Mfg. Corp., Mishawaka, Ind.
Hazard Mfg. Co., Wilkes-Barre, Penn.
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Link-Belt Co., Chicago, Ill.—see page 5 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
George C. Moon Co., Garwood, N. J.
Pittsburgh Mining Machinery Co., Pittsburgh, Penn.
John A. Roebling's Sons Co., Trenton, N. J.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., New York, N. Y.
Williamsport Wire Rope Co., Chicago, Ill.—see page 12

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American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Chicago, Ill.—see page 254
General Electric Co., Schenectady, N. Y.
Hazard Mfg. Co., Wilkes-Barre, Penn.
John A. Roebling's Sons Co., Trenton, N. J.
Standard Underground Cable Co., St. Louis, Mo.
United States Rubber Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn.

Classified Advertisements

POSITIONS WANTED — POSITIONS VACANT
Two cents a word. Minimum, $1.00 each insertion, payable in advance.

INFORMATION
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USED EQUIPMENT

Mine Cars, Rails and Locomotives

We have a number of good, serviceable, standard gauge, second hand locomotives, and narrow gauged ones, for immediate shipment.

M. K. FRANK
15 Park Row, New York City
Union Trust Building, Pittsburgh, Pa.

FOR SALE
QUARRY CARS

30 all steel, standard gauge, Quarry Cars, especially rugged construction, 13 cu. yds. capacity. Automatic couplers, hand brakes, good condition.

NAZARETH CEMENT COMPANY
Nazareth, Pa.

Marion 41, mounted on traction wheels, condition excellent. Price attractive.

DAVID EVANS
32 West 40th St. New York City

12-K GYRATORY

Also Nos. 10, 9, 8, 7½, 6, 5, 4, 3
Roll Crushers
84x72, 36x60, 24x54, 18x30
Jaw Crushers
36x42, 24x54, 22x52, 18x36, 72x30-in.
Disc Crushers
48-in., 36-in., 24-in., 18-in.
120 H.P. Gasoline Engine Power Take Off
15 Ton Locomotive Crane—8 Wheel.
25 Kw. New 250—125 V. Gasoline Eng.
New 78x20 and 78x25 Screens.

Ross Power Equipment Co.
11 South Meridian St., Indianapolis, Ind.

WANTED

One 4-stage centrifugal pump with capacity of 800-1,000 gallon per minute. Give complete description, price and location. Address

Box 1847, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

FOR SALE — ELECTRIC MOTORS

Reconditioned like new—and guaranteed—America's largest stock—all at prices far below original cost—send for "monthly Bargain Sheet" showing net prices — MOTORS and GENERATORS RENTED — EXCHANGED—REPAIRED. ALL SIZES up to 250 hp.

GREGORY ELECTRIC CO. CHICAGO, ILLINOIS
Established 1893
16th and Lincoln Sts.
Chicago, Ill.

FOR SALE

Approximately 1500 feet No. 114 Manganese Steel Ewart Detachable Conveyor Chain; never used. Address

Box 1834, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

WANTED

Gayco or Emerick Air Separator, 14 feet in diameter or nearest size you have. Give best price, location, full particulars. Address

Box 1832, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

CRANE:

1—20-ton, 8-wheel BROWN HOIST Locomotive Crane, Shop No. 8247, built 1921, A. S. M. E. boiler, 50-ft. boom; bucket operating; overhauled; guaranteed first-class condition.

STEAM SHOVELS:

4—TYPE B ERIE, full revolving, CATERPILLAR, built 1923 and 1922, A. S. M. E. boilers, ¾-yd. dippers; High Lift and Standard Booms; excellent condition.

DUMP CARS:

18—4-yd., 36" gauge, K. & J., Heavy Duty, 4-pedestal, STEEL DRAFT BEAMS, built 1923, like new.

GREY STEEL PRODUCTS COMPANY
111 Broadway New York, N. Y.

WANTED

Second-hand Jaw Crusher, about 12x24. Give size, condition, manufacturer and lowest price.

G. & W. H. CORSON,
Plymouth Meeting, Pa.

BUCYRUS STEAM SHOVEL

14 B, full steel caterpillar, ¾ yd. dipper, full revolving, boom hoist, new 1922, idle this season, fine mechanical condition and appearance. Good as new. Immediate release. $5,500 cash, loaded. Stand any inspection. A decided bargain.

H. Y. SMITH CO., Milwaukee, Wis.

NEW BOILERS

4 Geary Water-tube Boilers, 250 H. P. each, have never been used. For sale cheap if moved quickly. Will sell one, or two, or all.

Pittsburgh Machinery & Equipment Co.
1302 Fulton Bldg. - Pittsburgh, Pa.

FOR SALE

Steamshovels

1—Marion 300 stripping shovel, 8 yd. dipper.
1—Bucyrus 225B stripping shovel, 6-yd. dipper.
1—Bucyrus 95C RR type shovel, 4½ yd. rock dipper.
1—Marion 92 RR type shovel, 4½ yd. rock dipper.
2—Bucyrus 70C RR type shovels, 2½ yd. dippers.
2—Marion 60 RR type shovels, 2½ yd. dippers.
1—Bucyrus 50B caterpillar high lift, 1¾ yd. dipper.
1—Marion 37 caterpillar high lift, 1¾ yd. dipper.
1—Bucyrus 35B caterpillar high lift, 1½ yd. dipper.
4—Marion 36 caterpillar high lift, 1-1½ yd. dippers.
2—Marion 28 caterpillars, ¾ yd. dippers.
2—Marion 21 caterpillars, ¾ yd. dippers.
1—Marion 31 caterpillar, 1 yd. dipper.

Locomotives

2—48 ton std. gauge 18x24—6-wheel switchers.
1—40 ton std. gauge 16x24—4 wheel switcher.
2—50 ton std. gauge logging engines.
2—60 ton Mogul type.
4—12-18 ton 36" gauge steam locomotives.
6—8-10 ton 24" gauge steam locomotives.
5—7-8 ton 36" gauge gas locomotives.
7—3-6 ton 24" gauge gas locomotives.

Cars

16—12 yd. Western std. gauge side dump cars.
30—13 yd. Steel std. gauge side dump cars.

WRITE FOR COMPLETE LIST

F. E. HOUCK
4317 North Western Avenue, Chicago
Tel. Keystone 6612

Rock Products Classified Ads Produce Results

Extract from one of many similar letters from satisfied advertisers:

"In response to your recent letter asking for permission to repeat our advertisement, we wish to say that we have received so many inquiries as a result of the four time advertisement just completed that we do not think it advisable to continue same. We were very much pleased with the inquiries that were made and we take this opportunity to thank you for the prompt forwarding of those inquiries."

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USED EQUIPMENT

Locomotives, Locomotive Cranes, Etc.

70-ton 3-truck Shay, built 1912.
42-ton 2-truck Shay, built 1907.
60-ton 6-wheel switcher, separate tender, built 1902.
30-ton 8-wheel 2-line McMyler locomotive crane, 70′ boom.
18-ton O. & S. locomotive crane, 45′ boom.

Also other locomotives and locomotive cranes, steam shovels, steel rails, etc. Complete list furnished on request.

Birmingham Rail & Locomotive Company
Birmingham, Ala.

Machinery for Sale

DRYERS—Direct heat rotary Dryers, 3′x20′, 3½ x25′, 4x30′, 5½x50′, 6x60′ and 7x60′; double shell dryers, 4x20′, 5x30′ and 6x35′; steam heated air rotary Dryers, 4x20′, 5x25′, 6x30′.
KILNS—Rotary Kilns, 4′x40′, 5′x50′, and 6′x70′, 6′x125′, 7′x80′.
MILLS—6x8′, 6x5′, 5x4′, 3x3½′, pebble and ball Mills; No. 86 Marcy Mill; 33″ and 24″ Fuller-Lehigh Mills; 3x8′, 4x16′, 4½x20′, 5x11′, 5x20′, 5½x22′, Tube Mills; 7½x13″, 9x15″, 12x26″ and 18x36″ Jaw Crushers; One "Infant" No. 00, No. 0, No. 2, No. 3 and No. 9 Williams swing hammer mills; one Kent type "G" Mill; 24″, 36″, and 40″ Cage Mills, 3′ and 4½′, 6′ and 8′ Hardinge Mills, 18x12″, 20x14″, and 30x16″ Crushing Rolls. No. 0, No. 1 and No. 2 Sturtevant rotary Crushers; No. 0, No. 1 and No. 2 Sturtevant ring roll crushers, 5 roll and 4 roll, No. 1 and No. 000, No. 00 and No. 0 Raymond Mills; one No. 3, No. 4 and No. 7½ Telsmith Breaker; one 36″ Sturtevant Emery Mill; one 3 roll Griffin Mill; 60″ Chaser Mill; No. 1 to No. 10 Gyratory Crushers. SPECIALS—Jigs, Concentrating Table, Newaygo and Hum-mer screens; 8′ and 10′ Emerick and Raymond Air Separators; ore feeders, Air Compressors—hoists.

W. P. HEINEKEN, Engineer
95 Liberty Street, New York City
Tel. Cortlandt 1841

"Komnick System" Modern Sand Lime Brick and Slag Brick Machinery

Constructed for efficient service. Largest production sharp edge smooth surface bricks at lowest operation costs.

Brick-loading device—1000 bricks loaded on motor truck at once.

"Ternolite Fireproof Roofing Machinery"

For prices for complete units and particulars, address

Komnick Machinery Company
1010 Lafayette Bldg. Detroit, Mich.

FOR SALE

1 No. 4 Six-Cylinder Kritzer Lime Hydrator. NEW

Our Specialties

ROTARY KILNS	TUBE MILLS
ROTARY DRYERS	BALL MILLS
GYRATORY CRUSHERS	CAGE MILLS
CRUSHING ROLLS	HAMMER MILLS
JAW CRUSHERS	PULVERIZERS

And Kindred Equipment

THE EQUIPMENT SALES COMPANY

Nashville, Tennessee

RAILS

NEW—RELAY
Frogs
Switches
Tieplates
Bolts—Spikes
From Warehouse Stock

S.W. LINDHEIMER
38 S. DEARBORN ST. CHICAGO

LOCOMOTIVES

25 ton Davenport 4-driver S. T. Switcher.
48 ton Baldwin 4-driver S. T., 17x24 cyls.
42 ton 2-truck Shay Geared Locomotive.
4—65 ton Baldwin type 2-6-0 Moguls, with tenders. Fine switching locomotives, 19x 26 cyls., 190 lbs. steam. First class.

CARS

10—12 yd. Western Hand Dump Cars.
35—80,000 lbs. cap., 660 cu. ft. All-Steel Center Hopper Bottom Dump Gondola cars, MCB.
40—100,000 lbs. cap., 1040 cu. ft. Steel Underframe Rodgers-Hart Gondola cars, convertible to center dump.

RAILS

Large stocks New and Relay, all weights. Switches, Tie Plates, Spikes, etc. Immediate shipment.

Wire or write

HYMAN-MICHAELS COMPANY
Railway Exchange Bldg. St. Louis, Mo. **Peoples Gas Bldg. Chicago, Ill.**

SITUATION VACANT

WANTED

Draftsmen familiar with cement plant layout work and cement mill machinery. Apply by letter to

FULLER-LEHIGH COMPANY,
Box 35, Fullerton, Pa.

Draftsman and Designer

Drafting Room position open for a young Engineer or Draftsman who has had several years' experience with cement plant design and construction. Send letter with full particulars as to technical training and practical experience; also state salary expected. Location, New York City. Address

Box 1849, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Superintendent Wanted

For Eastern plant manufacturing Gypsum Wall Board and Plaster Board. In reply state in detail, age, qualifications, experience, salary desired, etc. Address

Box 1850, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

Classified Advertisements

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SITUATIONS WANTED

CONSTRUCTION ENGINEER

Specializing on rock crushing, cement, lime plants, etc., in their entirety, desires engagement with producer or manufacturer. Fifteen years' experience. Location immaterial. Address

Box 1825, Care of Rock Products
542 South Dearborn Street, Chicago, Illinois

POSITION WANTED

As Superintendent or General Foreman of stone and sand crushing plants. Have had fifteen years' experience in operating quarries, also grinding and washing sand. Address

Box 1838, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Situation Wanted

I will be open for engagement as Production Manager or Superintendent of Quarries on February 1, 1924. I have had large experience in both large and small rock crushing enterprises. Am thoroughly acquainted with both electric and steam power, steam shovels, large blasting, and everything that goes with an up-to-date plant. I have been in my present position for the past three years, but desire a change on account of the climate. I am a member of the National Crushed Stone Association and will attend the January meeting. I would like to hear from any one needing my services, before this meeting, so that I could arrange a personal interview at that time. Address

Box 1848, Care of Rock Products,
542 South Dearborn Street Chicago, Ill.

SUPERINTENDENT

with long experience in sand, gravel and crushed stone desires engagement. Knows equipment and realizes importance of volume production. Well educated and familiar with engineering problems peculiar to these industries. Married. Available soon. Address

Box 1844, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Young married man desires position as superintendent or manager of quarry or sand and gravel plant. Have had five years' experience. Address

Box 1852, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Take advantage of the Opportunity offered in the Used Equipment Department to dispose of the equipment that you no longer need.

SITUATIONS WANTED

Situation Wanted

Wanted, permanent connection with industrial or mining corporation. I have 16 years' experience including design, construction, operation and repairs, 6 years at present location as superintendent. Have good reasons for desiring change. Correspondence and interview invited. Address

Box 1853, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

BUSINESS OPPORTUNITIES

FOR SALE

Two-thirds interest in a high-grade limestone quarry for concrete and agricultural lime, now operating with orders for the balance of the season. Can sign up contracts for the entire output for the next year at good prices. Located on two railroads. A bargain if taken at once. Good reason for selling. Address

Box 1845, Care of Rock Products
542 South Dearborn Street. Chicago, Ill.

FOR SALE

The plants of The Franklin Mfg. Company located at Franklin, Pa., and Stoneboro, Pa.

The Franklin plant is a complete plant for the manufacturing of Journal Box Packing for the Railroad trade, also a complete plant for the manufacturing of Asbestos Pipe Covering, Asbestos Millboard, Asbestos Felts and Asbestos Cement. (One and one-half acres of ground).

The Stoneboro plant is a complete plant for the manufacturing of Magnesia Pipe Covering, Magnesia Blocks, Magnesia Cement, Magnesia Carbonate and Calcine. (Thirty-three acres of ground.)

For information address:

J. R. Grundy, Agent, Franklin, Pa.

FOR SALE

Complete lime calcining plant, two modern kilns, abundant supply high calcium limestone. Directly connected two railroads. Situated in beautiful Shenandoah Valley of Virginia. For details address

P. O. Box 377. Staunton. Virginia

FOR SALE

250 acres hydrated lime and commercial stone land, 9 miles from city of 300,000 population on two railroads. Located in famous Woodville, Ohio, district. Bargain price.

GRANTHAM REALTY CO.
412 Gardner Building Toledo, Ohio

FOR SALE

Sand and Gravel Pit, 2 miles of Lodi, O. Railroad on each side of pit, also running water for washing sand. Millions of yards. Stands test in Columbus, Ohio. Convenient to load. Correspondence invited. Address

Box 1851, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

BUSINESS OPPORTUNITIES

Receiver's Sale Notice

Plant Located on the Illinois Central and the Ohio River.

The quarry is well opened, has an open face about 400 feet long, 65 feet high, and there is no overburden. Official analysis of stone or other particulars furnished on application to the Receiver.

State of Illinois. Pope county.—ss.

Pope County Circuit Court, October term, A. D. 1924.

In the matter of the Egyptian Iron Works vs. Golconda Portland Cement Company.—Creditors' Bill.

Public notice is hereby given, that pursuant to a decree entered in the above entitled cause, in said court, on the 22d day of November, A. D. 1924, I, Chas. Durfee, heretofore appointed receiver in said cause, will, on the 5th day of January, A. D. 1925, at 12:30 o'clock in the afternoon of said day, sell at public auction, free and clean of all liens and encumbrances, to the highest bidder with the Crushing Plant of the said Golconda Portland Cement Company, one-half mile north of Shetlerville Station, in the county of Hardin and State of Illinois, the following property, to-wit.

1 Hamilton Corliss, 500 H. P. engine.
1 500 H. P. Generator (direct connected).
1 A. C. exciter, belt driven, with switch board, and all necessary switch board equipment.
1 O'Brien & O'Brien Boiler, Westinghouse mechanical (stoker) and stack, all feed water pumps, complete.
1 Air Compressor.
1 No. 8 Gyratory Crusher, 99 per cent new.
2 No. 5 Gyratory Crushers, 50 per cent new.
1 5x24 foot revolving screen, 90 per cent new.
1 65 foot continuous bucket belt driven elevator, 90 per cent new.
1 150 Horse Power Motor.
1 100 Horse Power Motor.
1 50 Horse Power Motor.
1 35 Horse Power Motor.
1 25 Horse Power Motor.
1 Steam Shovel.
All tools, piping and rails, in place.
All office Furniture.
58 acres of land located in Hardin County, Illinois, including Crushing Plant Construction, Shop Construction, Power Plant Construction.
500 feet of new railroad track and all other construction work and personal property formerly owned by the Golconda Portland Cement Company, and used in the operation upon the said 58 acres of land, together with all and singular the tenements and hereditaments thereunto belonging.

Terms of sale, cash, the purchaser being permitted to make an initial deposit of 10 per cent of his bid and be given thirty days from the date of said sale to pay the balance over to said receiver.

Dated, December 3d, 1924.

CHAS. DURFEE,
Receiver, Golconda Portland Cement Company,
B. F. Anderson, Attorney. 12-11-25

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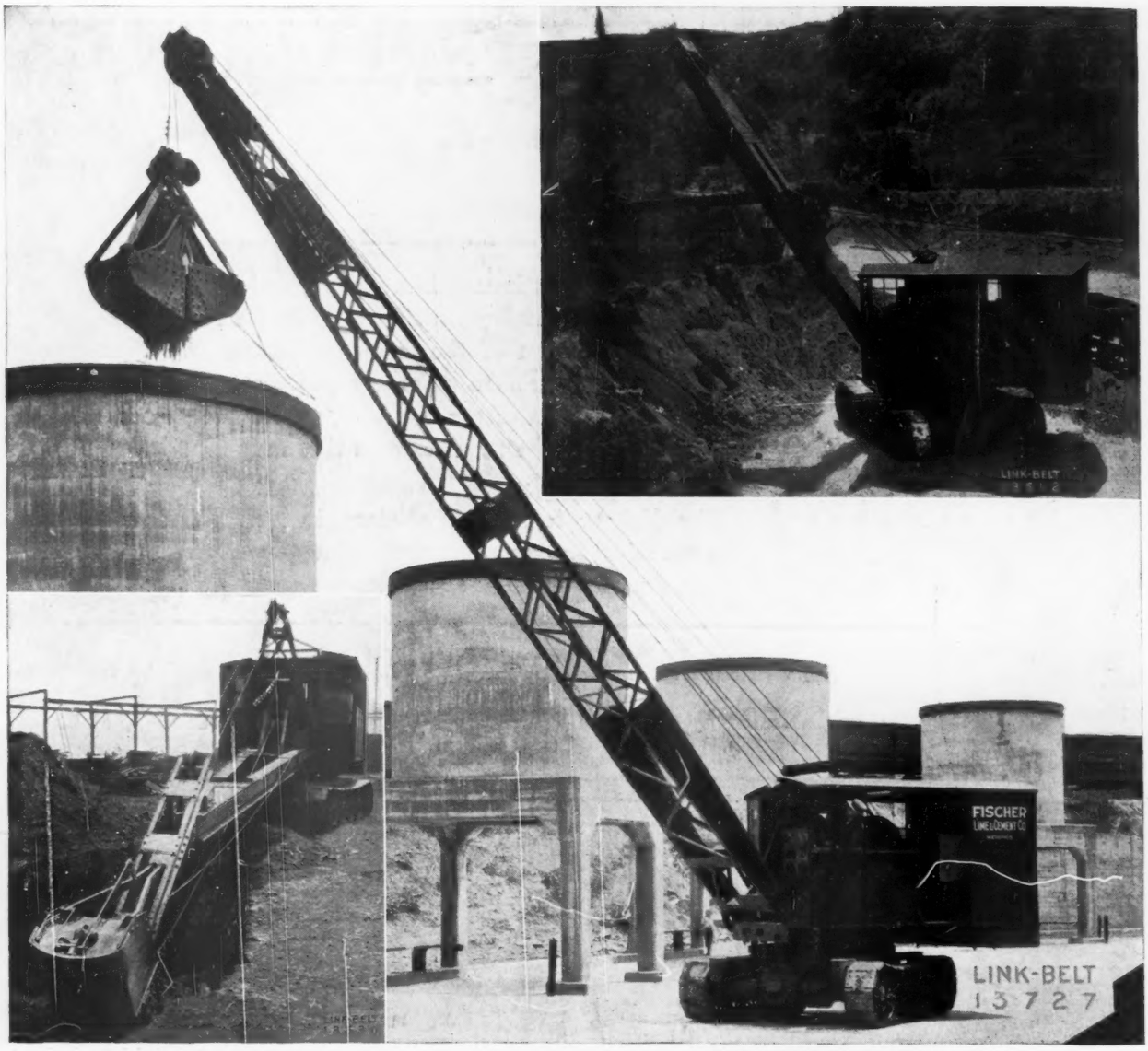

On Your Next Job Use A Link-Belt Gasoline Crawler

THIS YEAR LINK-BELT IS FIFTY YEARS OLD

WHATEVER your work—moving aggregate, or driving piles, excavating, or digging trenches, this machine is a profitable investment.

A very important feature is that the entire lower driving mechanism of the crane is completely protected by housings. At a small expense the crane can be changed from boom and grab bucket to a gasoline shovel—from a drag line excavator to a trench digger.

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